

Fostering Transformative Learning in an Informal Collaborative Process

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Dedication

In memory of Ken Luckenbill, 1952 to 2012

A life-long learner, outdoorsman, business partner and friend

Abstract

Social and collaborative learning in natural resource management has been used for more than two decades to address wicked problems, however evidence of transformational learning, the types of transformation and how participants' meaning structures and perspectives change has received little research attention. The link between learning and changes in understanding was investigated as part of the Seven Mile Creek Fuelshed Project (SMCFP). SMCFP was a transdisciplinary research project aimed at examining options for multi-functional agriculture in south central Minnesota, United States. Analysis of data from observation, interviews and focus groups were used to explore the participant experience of the SMCFP. Mezirow's (1991b) transformative learning theory was used as a lens. The study introduces the use of Wiggins and McTighe's (2006) six facets of understanding as a means to code qualitative data and to assess transformative learning. The study provides evidence of transformative learning in each of the following areas: elaboration of frames of reference, creation of new meaning schemes, transformation of meaning schemes and transformation of meaning perspectives. The results provide evidence of how people learn in a collaborative process and provide a foundation for the design of adult education and Extension education programs. The conditions that fostered transformative learning in this case study included a clear project focus, the introduction of expert knowledge, the incorporation of local knowledge, deliberation, dialogue and reflection. The SMCFP opened participants to new ideas for protecting water quality, wildlife habitat, and economic management of an agricultural landscape.

Keywords: Adult education, Extension education, Collaborative Learning, Learning environment, Social learning, Transformative Learning, Facets of understanding

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Chapter 1 -- Introduction

The American public universities known as land-grant institutions were established by the Morrill Act of 1862 for the purpose of providing citizens access to higher education (Davenport, 1952). These new colleges, which emphasized agriculture and mechanic arts, gave opportunities to thousands of farmers and working people (Davenport, 1952). This was a great contribution toward a well-informed citizenry. A well-informed citizenry may be considered essential to addressing social issues and the development of a better society.

As the contestability of solutions to social issues increases, the need to provide access to education and engage citizens in decision-making increases. As a means to engage citizens in the decision making process, the use of informal collaborative processes has grown (Daniels & Walker, 2001; Innes, 1996). Research on collaborative planning has shown that participants' perceptions change as participants are introduced to new ways of viewing the problem and its potential solutions. However, an understanding of linkages between learning and changes in perceptions has been elusive (Johnson, 2010; Muro & Jeffrey, 2006).

The purpose of this case study was to explore the links between learning and change in individual participant's perceptions. This study was conducted as one part of a larger project focused on exploring biomass production in a highly productive agricultural landscape in south central Minnesota. The knowledge gained from this research will improve educational and participatory practices addressing intractable issues (Daniels & Walker, 2001; Martin & Murray, 2011; Rittel & Webber, 1973). Often

called *wicked* problems, examples include climate change and environmental degradation (Martin & Murray, 2011; Raison, 2010). This research employed a phenomenological approach to examine the participant view of learning in the context of an informal collaborative process. Multiple data collection methods were employed.

This chapter provides background and context for adult learning, specifically in the context of the land-grant institutions' Extension education system. The chapter also summarizes the nature of wicked problems and transformative learning. Transformative learning may be the type of learning required for individuals to address these wicked problems. This is followed by the problem statement, statement of purpose, and research questions. Finally, the researcher's perspectives and assumptions are presented.

Background

In K-12 and adult education a tension exists between education for the development of the individual and education to address social issues through engagement (Peters, Jordan, Adamak, & Alter, 2005; Rorty, 1989). Rorty suggests that a synthesis of education for the development of the individual and education for the purpose of engaging people in social change can be found through the lens of Dewey's progressivism, which addresses the relationship between the individual and society. Aronowitz (2009) suggests that when development of the individual and development of society are balanced, education creates citizens who can actively participate in democracy. The development of the individual and the development of society are reflexive and recursive. As society nurtures the development of individuals, individuals are better equipped to engage in critical reflection and dialogue about social problems.

Mezirow (1991a) provides two arguments supporting the need for adult education to focus on social change. The first is that individuals who can reflect on their experience and enter into dialogue with others can change society for the better. Mezirow (1991a) believes that the role of education, especially given the pace of change in society, is to “assist learners to negotiate their own meanings and values rather than passively accept the social reality defined by others” (The arguments section, para. 2). He claims that the second reason adult education should focus on social change is to promote social justice. All adults have a contribution to make to social change, and an individual’s status in society should not preclude participation in civic discourse (Mezirow, 1991a).

Boyer (1990) argues there is a need to connect “the work of the academy to the social and environmental challenges beyond the campus” (p. xii). Boyer further believes that universities can serve a significant role in addressing this need by redefining what it means to be a scholar. The potential role of the scholar in education for social change is described by Peters, Jordan, Adamak, and Alter (2005) as engagement between scholars and citizens that contributes to democracy and to social change. This role, the role of service, is carried out by the professorate and through the land-grant Universities Extension Education system. While the balance between teaching, research and service at the land-grant university system has been a topic of interest and debate, the need for engagement between scholars and citizens has not abated (Boyer, 1990; Glassick, Huber, & Maeroff, 1997).

To further understand the land-grant system and engagement between the university and citizens, a discussion about the foundation of the Cooperative Extension

System follows. The Cooperative Extension System was founded in 1914 by the Smith-Lever Act. It is dedicated to adult and youth education in pursuit of social change. This system is a partnership among the state land-grant educational institutions, the United States Department of Agriculture, and local units of government (Peters, 2006). There is at least one Extension organization in every state and territory (U.S. Department of Agriculture National Institute of Food and Agriculture, 2012).

While the Cooperative Extension System can be effective in public outreach programs addressing social change, Peters (2006) notes that Extension in particular has not yet reached its potential for catalyzing social change. Mezirow (1991a), in a policy paper prepared for the American Association of Adult and Continuing Education, argues that adult educators have abandoned their mission of effecting social change. While Mezirow's call for adult educators to embrace adult education for the purpose of social change is more than 20 years old, the reasons he cites are timeless. The reasons include the need for individuals to adapt to a rapidly changing society by transforming how they as individuals make meaning and the need to address issues of social justice (Mezirow, 1991a). Mezirow (2000) describes a process of learning that enables adults to make meaning in a world where "the human condition may best be understood as a continuous effort to negotiate contested meanings" (p. 3). Transformative theory is that process. In brief, transformative theory explains the ongoing process of creating meaning from reflection on experience. It is through critical reflection on one's own perceptions and through dialogue that one's way of thinking and acting is permanently changed (Taylor, 2008). This process is central to adult education and is an essential element of social

action in a democratic society. Mezirow (1993) describes three phases in adult education for social action. These include “creating awareness of the need for change by critical reflection and the introduction of new perspectives, encouraging affective learning leading to a feeling of solidarity with others . . .[and] facilitating instrumental learning about how to overcome . . . constraints on action” (p. 183). Adult educators must be vigilant to focus effort on the praxis between learning and action. The praxis between learning and action is so important Mezirow (1993) states, "Awareness without action is an abortion of the learning process” (p. 183-184).

A reason Extension has not lived up to its potential for addressing social change is the expert model “no longer provides the value it once did” (Raison 2010, conclusion). Raison (2010) suggests that a dichotomy exists between use of the expert model and use of a more collaborative model in Extension education. The expert method of teaching is useful for learning skills while transformative group learning, a specific form of collaborative learning, is more suited to addressing complex social issues (Cranton, 1994). As a means to address issues of social change more effectively, Franz (2007) calls on Extension to adopt transformative learning and critical approaches to the delivery of Extension education programs.

Transformation of perspectives through the use of transformative educational methods can catalyze change in social systems (Mezirow, 1991b; Mezirow, 2009). Likewise Martin and Murray (2011) describe how education can address complex social issues, or wicked problems, through personal and organizational change. They further explain that education addressing wicked problems often “focuses on making personal

meaning of the sustainability idea, making personal connections with the underlying issues, mobilising [*sic*] personal core values to deepen intention, and the development of empowering beliefs that can support and enable positive action” (p. 167). Moreover, Rittel and Webber (1973) suggest that collaborative learning approaches should involve the participants most affected by the wicked problem. Franz (2007) and Raison (2010) posit that to continue to be effective, competitive, and efficient in the 21st century, Cooperative Extension needs to focus on adopting transformative and critical teaching methods in education.

Of particular interest in this study were participants’ lived experiences of an informal collaborative process. These experiences can provide insight into the links between learning and action. The findings from this research will be of interest to those interested in transformative learning theory and of practical use to adult educators who are addressing complex social issues.

Problem Statement

The use of transformative and critical learning methods in adult education and especially in Extension education as a means to catalyze social change needs study (Franz, 2007). This is especially true in Extension education programs, where renewed attention has been directed at scholarly engagement and education for social change (Peters, et al., 2005; Peters, 2006). In the context of collaborative planning processes, an understanding is needed of the participant and facilitator experience of learning and of how transformation of perspectives links to solutions of wicked problems (Johnson, 2010; Daniels & Walker, 2001).

Purpose Statement

This research explored the participant experience of learning in an informal collaborative process. In an informal collaborative process, as opposed to a formal collaborative process, the methods and outcomes are not guided by local, state or Federal regulations. The findings of this research contribute to a better understanding of the links between learning and change in participant perspectives. Through this understanding adult educators will be able to improve their teaching practice, especially when engaging participants in education about wicked problems. This research also added to the understanding of learning in an informal collaborative process.

Research Questions

In the context of an informal collaborative process conducted as a part of the Seven Mile Creek Fuelshed Project, the following research questions were addressed:

1. What are the participants' experiences with collaborative processes?
2. What are the participants' experiences regarding transformative learning?
3. What are the links between transformational learning and changes in participants' understanding of agriculture in the Seven Mile Creek Fuelshed Project?

Research Context

The Seven Mile Creek Fuelshed Project explored options to improve water quality, increase wildlife habitat and provide for economic return to farmers through biomass production. The project is described by Jordan, Schively Slotterback, Valentine Cadieux, Mulla, Pitt, Schmitt Olabisi, and Kim (2011) as a communicative approach to systemically assess the implementation of multi-functional agriculture in the Minnesota

River Basin. Participants included agency staff, non-governmental organizations, farmers and farming interests involved or interested in agriculture.

The project location was near St Peter, Minnesota, United States. Eight participant workshops were held between June of 2013 and March of 2014. The first four workshops provided opportunities to learn about biomass production and a new ammonia fiber expansion (AFEX) biomass processing technology. The AFEX treated biomass results in pellets that can be fed to ruminant animals. This creates a market for the biomass that can compete with crops typically produced in the St Peter area.

The remaining four workshops explored win-win strategies for producing food, biomass, conservation and wildlife. A geo-design tool was used by small groups of participants to create multiple landscape designs. These designs included six combinations of production options: corn, switch grass, prairie grass, conservation tillage, stover production, and low phosphorous crop production. For each design, real time feedback on six performance objectives was provided. These performance objectives were carbon sequestration, farm market gain or loss as compared to corn, phosphorous loading, sediment production, water yield, and wildlife habitat. This feedback provided participants a means to evaluate their design's performance and adjust accordingly. The geo-design tool used a geographic information system to provide information from five data layers: agricultural crop productivity, highly erodible soils, surface water quality contamination potential, wetland restoration, and significant wildlife habitat. The geo-design tool enabled participants to propose ideas and vet them through a deliberative process.

Assumptions

One of my assumptions is that knowledge is both socially constructed and is a social construct. Packer and Goicoechea (2000) suggest that learning entails both epistemology and ontology—that is, knowledge is both socially constructed through interaction with others and defined by the context and cultural norms of the social setting. This is consistent with Lowes' and Prowse's (2001) view of phenomenological data collection where the researcher and the informant are co-participants in the research process. Since the researcher and the participant influence each other, setting aside or bracketing of preconceptions was not possible. This interaction was an expected part of the exploration of the links between learning and action in an informal collaborative process.

In different words, there is also an interaction between epistemological and ontological knowledge. Packer and Goicoechea (2000) indicate that the underlying motivations for behavior may be related to the participant's implicit epistemic and ontological assumptions. Bawden (1998) and Gardner (2011) would, in addition to interactions between epistemological and ontological knowledge, include beliefs about the nature of goodness and beauty as a motivation for behavior.

My Research Approach

Finding a synthesis between teaching for individual betterment and teaching for social benefit within the context of my work as an Extension educator drives my interest in research on the link between learning and action. As a novice educator, in 1995, my approach to teaching was from a view that Extension teaching should focus on building

skills. My current view of teaching and learning is that it is a constructive endeavor that enables citizens to collectively learn their way to a better society (Bawden & Reichenbach, 2010). The following narrative describes my background and my motivation for conducting research on transformative learning. This interest grew out of my Extension teaching and a search for synthesis between teaching for individual development and teaching for social change (see Figure 1).

If the Cooperative Extension System is to remain a viable organization, it must focus on solving issues of concern to society (Franz, 2007, 2014; Peters, 2006). A dichotomy exists between teaching for individual benefit and teaching to address social issues. I believe that a synthesis between these two teaching purposes is possible and that Extension education programs can simultaneously develop both the individual and society.

Learning is influenced by the participant's perceptions of the world, including the participant's perceptions of past, present, and future. In this sense, learning is not an individual endeavor; instead, it involves a community of people co-constructing knowledge. Given this view, there is no fixed reality. Huebner (1975) stated that "Human life is never fixed but is always emergent as the past and future become horizons of a present" (p. 244).

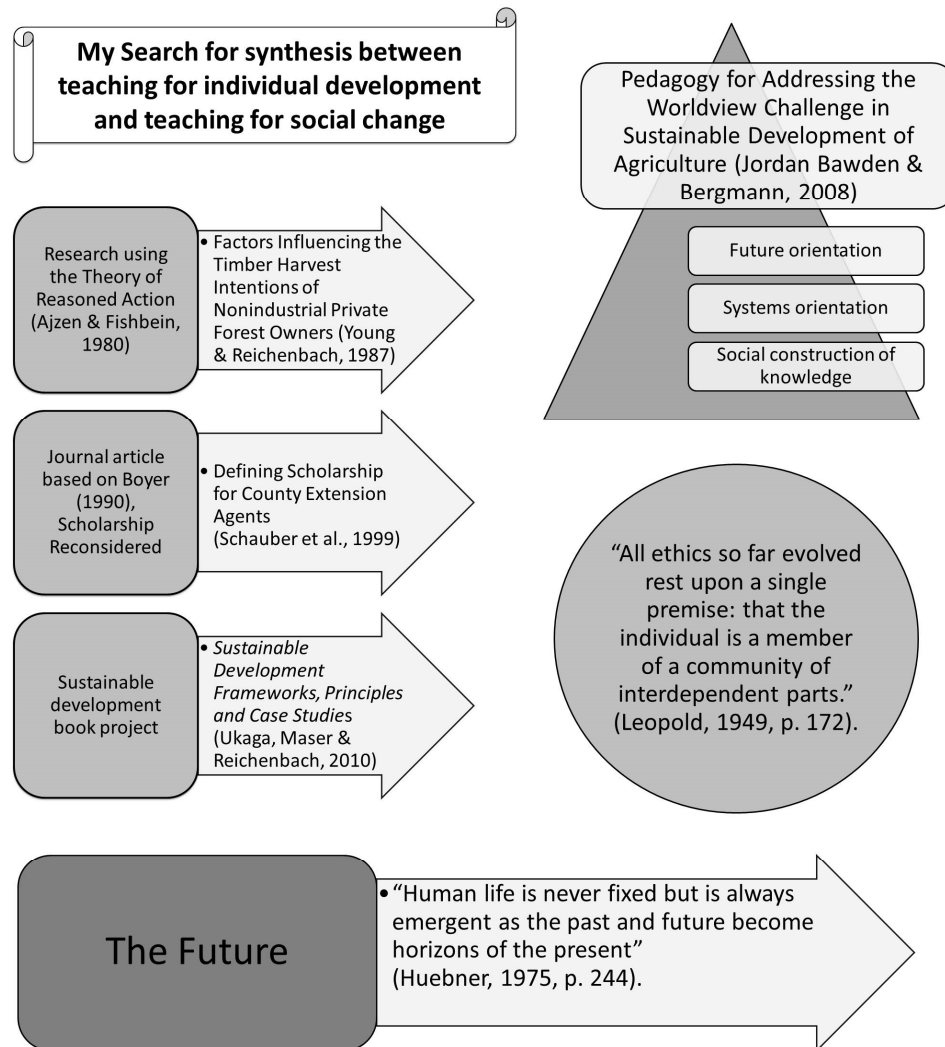


Figure 1. My search for synthesis.

An individual's desire for learning is shaped by historical and social contexts (Merriam, Caffarella & Baumgartner, 2007). These authors also indicate learning is guided by the learners' interest in addressing specific problems, social connections with others, and a desire to learn. Education to enable individuals to engage in civic debate and shape the course of society involves understanding the historical and social context that shapes one's desire to learn.

My concern for teaching for both individual benefit and the social good are intertwined. The educator's role is to provide experiences that both develop the individual and simultaneously enable the individual to respond to and shape social change. The experiences of the individual are central to both guiding education for individual benefit and to how the individual interacts with others to improve society. This interconnected nature of adult education is recognized by administrators within the Cooperative Extension System. Colien Heferman, previous administrator at the National Institute for Food and Agriculture, discussed how Extension's educational programs must have a social impact and a focus on societal goals in addition to focusing on individual wants or needs (personal communication, May 13, 2010).

My interest is in trying to understand the connection between learning and change in perceptions. This interest transcends finding answers to questions about the participants' satisfaction with a class and even transcends finding out if the participant learned. My interest is linking learning to individual change that enables the participant to address wicked environmental problems.

While I am interested in social change, I am committed to facilitating processes where participants are enabled to choose their own course of learning and take actions they believe are necessary. This may stem from views I developed during research conducted as part of my Masters in Science work on the Intentions of Private Forestland Owners to Harvest Timber (Young & Reichenbach, 1984). Ajzen and Fishbein (1980) propose that behavior can be predicted by intentions. The concept is that well-informed people make decisions that are compatible with their beliefs and norms and that beliefs

can change with new knowledge. This theory was used in my Masters research and later in my work with the Illinois Department of Conservation. My interests have expanded from the deductive approach taken by Ajzen and Fishbein (1980) to a more emergent and inductive approach as described by Mezirow's (1991b, 1993, 2000, 2009, 2012) transformative learning theory. From an applied research perspective, I endeavor to explore the links between learning, change in perception and action. Understanding these links has implications for the field of outreach and Extension education. Specifically, this research has increased my understanding of the processes that facilitate reflection, dialogue and deliberation.

Summary

David Mathews, President of the Kettering Foundation, in the preface to "Engaging Campus and Community," stated,

Practical wisdom is sound judgment about what should be done. . . . It is socially constructed in a type of dialogue called "deliberative." The ancient Greeks considered this the talk we use to teach ourselves before we act. Public deliberation is weighing possible courses of action to solve a problem against what people consider deeply important to their collective well-being. Perhaps the ultimate challenge for public scholarship is to find ways to contribute to the formation of practical wisdom. (Peters, Jordan, Adamak, & Alter, 2005, p. v)

In the introduction to the same book Peters states, "Renewing the academy's civic mission by engaging campus and community holds promise of contributing to the larger

task of renewing democracy" (Peters et al., 2005, p. 4). Johnson (2010) as well as Muro and Jeffrey (2006) suggest that enhancing the understanding of participatory approaches to solving social problems is needed.

This research may help others understand the links between learning and change in an informal collaborative process. This research may also benefit adult educators involved in public engagement for social change.

Definitions

Collaborative planning

Collaborative planning is a formal process of bringing stakeholders together for the purpose of reaching solidarity regarding action. The process is guided and influenced by a legal process instituted by a local, state or Federal agency.

Collaborative processes

Collaborative process is a term used to encompass both formal collaborative planning and informal collaborative processes.

Informal collaborative processes

Informal collaborative processes are those processes where stakeholders are brought together for the purpose of learning about the issue at hand and exploring options for action. The groups formed may or may not implement the actions that they have designed or recommended.

Meaning perspective

Mezirow (1993) defines meaning perspectives as assumptions that define an individual's expectations and understanding. He states meaning perspectives are formed

through experience. Meaning perspectives may be based in sociolinguistic knowledge, “e.g., social norms, cultural and language codes, ideologies, theories” (p. 180), epistemic knowledge, or psychological mechanisms. An example of a psychological mechanism includes, “repressed parental prohibitions which continue to block ways of feeling and acting” (Mezirow, 1993 p. 180).

Meaning scheme

A meaning scheme includes knowledge, beliefs, values, feelings and judgments that are used to interpret what is sensed or imagined (Mezirow, 1993). The statement “I want to ride a hog”, is likely to elicit confusion from the listener or thoughts of riding a Harley Davidson motorcycle. The confusion would arise if a person was unfamiliar with the term “hog” as used to describe a type of motorcycle.

Meaning structure

A meaning structure is the frame of reference that encompasses both meaning perspectives and meaning schemes (Mezirow, 1993).

Ontological knowledge

Ontological knowledge is an understanding of one’s own way of being. It is defined by the culture or cultures within which that person is found (Gee, 2000-2001). A person’s self-image is a socio-cultural construct that involves the social and physical environment as well as historic influences in a person’s life (Gee, 2000-2001; Stedman, 2003). Packer and Goicoechea (2000) state, “Ontology is the consideration of being: what is, what exists, what it means for something—or somebody—to be” (p. 228).

Three levels of cognition

Kitchener (1983) distinguishes between cognition, metacognition and epistemic cognition. Cognition is the process of knowing about things and the ability to relate various things or bits of knowledge in the mind. Metacognition subsumes cognition and is an individual's thinking process as used when solving ill-defined problems. Kitchener states that metacognition involves knowledge of self and others in the context of a goal, knowledge of the problem or processes that lead to the goal and the cognitive processes that guide the process of solving a problem. Epistemic cognition is an individual's awareness of the source of knowledge, how that knowledge is acquired and the limits of knowledge.

Transformative learning

Transformative learning is a permanent change in a person's meaning structures based on that person's experience, critical reflection on experience, and dialogue (Taylor, 2009). Transformative learning takes into account the interdependence of both the rational and affective thought processes and the context of the teaching and learning setting; it requires authentic relationships between all participants--whether teacher and student, facilitator and participant, or researcher and subject (Taylor, 2009). The focus for transformative learning is a continuum from individual change to social change (Taylor 2008). The terms transformative and transformational in reference to Mezirow's transformative learning theory are often used interchangeably in the literature.

Worldview

Worldview is the interaction of cognition, meta-cognition, and awareness of one's own epistemology and ontology (Bawden, 1998; Bawden, 2007; Kitchener, 1983).

Chapter 2 -- Literature Review

Transformative learning brings about changes in a person's views of the nature and limits of knowledge (Mezirow, 1991b, 1993, 2000, 2009, 2012). However, in the context of collaborative processes the mechanisms or key factors that catalyze transformative learning and how this type of learning connects to the creation of plans and actions to address wicked environmental and social problems is not well understood (Johnson, 2010). The exploration of learning based on the experiences of participants in an informal collaborative process will expand understanding of how learning is connected to changes in perceptions.

Introduction

The purpose of this case study is to explore the linkages between learning and change in participant perception. The literature review is divided into seven sections. The first section is an introduction to research on learning and collaborative processes. The second section provides insight into teaching as an intentional act in the context of a collaborative process. The third section is an overview of transformative learning and social constructivism as a way of being. The fourth section provides a summary connecting learning to action from the vantage of epistemology, ontology and ethics. The fifth and sixth sections include information on social learning and justification for using transformative learning as a lens. The seventh part provides information about gaps in the literature that this research will address.

Learning, Collaborative Processes and Action

Within the literature on collaborative planning two distinct views of learning are articulated. The first--learning to create a common understanding--is closely related to communicative knowledge. Cranton (1996) describes communicative knowledge as mutual agreement about social norms arrived at through collaborative group learning. The second is individual-centric learning which includes transformative learning (Rodela, 2011). Transformative learning is understood by Mezirow (2000) as “the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one’s experience as a guide to future action” (p. 5). Daniels and Walker (2001) argue that both types of learning, learning for common understanding and individual learning are important elements of the collaborative processes.

Several authors (Daniels & Walker, 2001; Deyle & Shively Slotterback, 2009; Innes & Booher, 1999; Muro & Jeffery, 2006) recognize learning as an important outcome of both consensus and collaborative planning processes. The learning process as described by these authors can be divided into two broad categories: learning that creates a convergence of understanding and learning that transforms the participants’ perspectives. The former is necessary for effective communication, and the latter is necessary for deliberation and action (Daniels & Walker, 2001). In their paper questioning social learning as a useful concept in participatory decision making processes, Muro and Jeffrey (2006) describe learning as a complex phenomenon that is hard to measure and understand.

Deyle and Shively Slotterback (2009) and Muro and Jeffrey (2006) suggest the purpose of learning in a collaborative planning process is the convergence of understanding so consensus can be reached. Deyle and Shively Slotterback (2009) demonstrate in a quantitative study of collaborative planning that participant perceptions of plan elements converge over the course of the collaborative planning process. They further report that understanding and agreement are necessary for plan implementation. Deyle and Shively Slotterback's work focuses on answering three research questions. The first concerns changes over the course of the planning process in participant perceptions of the planning problem and appropriateness of alternative solutions. The second concerns the active participation in the process. The third concerns the convergence of participant perceptions. According to these authors "group learning is an endogenous variable that is essential to reaching agreement and building constituencies" (p. 24). Relevant to understanding how the processes of consensus building and collaborative planning foster group learning, Deyle and Shively Slotterback pose the following question: "To what extent can the attributes of those processes affect the degree of group learning, the subsequent likelihood of agreement on plan policies, and the emergence of political constituencies for plan adoption and implementation?" (p. 24). The authors also state, "The greatest challenge may be identifying the phenomena about which to measure knowledge and perceptions at the outset of the planning process" (p. 26).

While a convergence of understanding is needed to communicate, understanding that enables the ability to communicate is not the same as transformative learning. The intentional facilitation of learning for transformation can catalyze participant engagement

in critical reflection, dialogue and deliberation. Due to differences between participants' past experiences, knowledge, insights and reflective processes, transformative learning may produce divergent understandings (Mezirow, 2000). Mezirow (1993), referencing the process of discourse in transformative theory, states, "In addition to consensus, discourse can lead to establishment of common meanings for discussing differences, better understanding of differences, respect for another's point of view without accepting it or to irreconcilable and incommensurable difference" (p. 180). Despite a potential for divergence in participant learning Steyaert and Jiggins (2007) propose that it is the social construction of the problem and potential solutions that lead to collective action.

Transformative learning, by "elaborating existing frames of reference, by learning new frames of reference, by transforming points of view, or by transforming habits of mind" (Mezirow, 2000, p. 19), enhances the individual's ability to enter into civic discourse.

Langan, Sheese, and Davidson (2009) suggest that an outcome of transformative learning is for students to "recognize and challenge the dominant ideological assumptions that are taken for granted in everyday discussions and representations of social (in)equalities" (p. 46).

Teaching about the subject matter at hand and facilitating transformative learning are important elements that may connect learning to action. Based on a critique of literature describing collaborative learning processes that foster social learning, Muro and Jeffery (2006) describe a chain of events linking social learning to action (see Figure 2). Muro and Jeffery "acknowledge that so far there is only limited evidence about the role of social learning in participatory processes and therefore it is difficult to judge its

usefulness as a prescriptive model” (2006, abstract). If social learning in a collaborative setting includes the transformation of meaning structures, then transformative learning may increase the ability to reach common understanding and also increase the ability to engage in civic discourse (Innes & Booher, 1999; Mezirow, 1993, 2000, 2009, 2012). Further, Daniels and Walker (2001) suggest that an increase in the ability to engage in debate can lead to the development of one or more well-documented arguments supporting action.

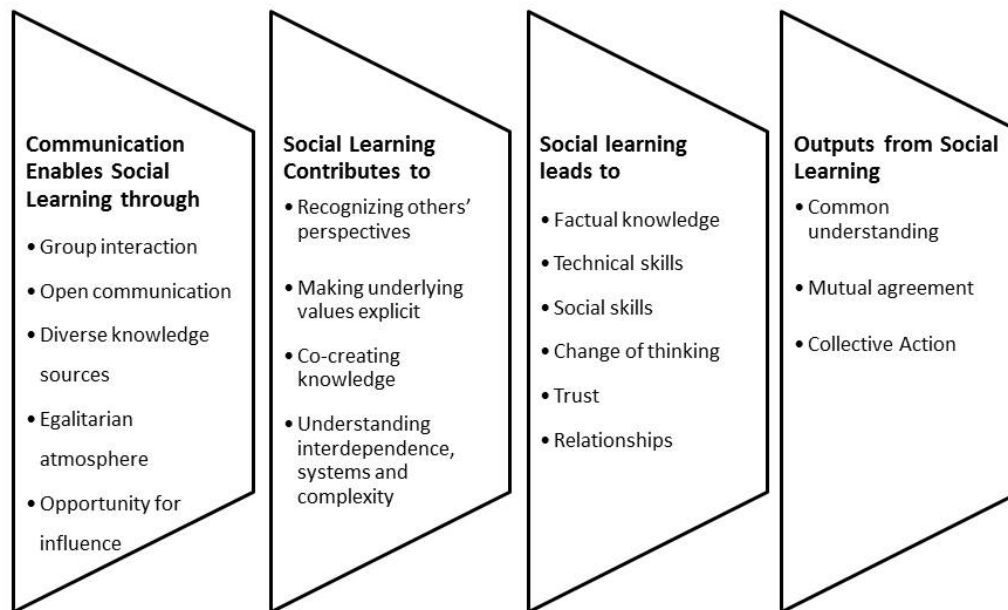


Figure 2. A composite model of social learning. Adapted from “Social learning – useful concept for participatory decision making processes?” M. Muro and P. Jeffery, 2006, Participatory approaches in science and technology (PATH) conference. Edinburgh, Scotland. Retrieved from http://www.macaulay.ac.uk/PATHconference/outputs/PATH_abstract_3.1.3.pdf

The Dialogue – Deliberation Continuum

A concept presented by Daniels and Walker (2001) describes a continuum from dialogue to deliberation as an integral part of the collaborative planning process. These authors provide a basis for the exploration of dialogue as one variable that links learning to action. Central to their idea of dialogue and deliberation are the need for common understanding and the transformation of perspectives.

Daniels and Walker (2001) contend that common understandings are essential to dialogue and that dialogue in what they term a *collaborative learning setting* is oriented toward communication competence and civic discovery. Because of the importance of this particular way of communicating, the term dialogue receives specific attention in the literature. Daniels and Walker reference Bohm (2003a) for their definition of dialogue. Bohm describes dialogue as the discussion of an idea while suspending one's own assumptions and values. To suspend one's assumptions requires collectively holding a number of ideas and values in mind as the topics at hand are considered. Innes and Booher (1999) also relate consensus building, a more specific form of collaborative planning to Bohmian dialogue. Bohm (2003b) states,

The spirit of dialogue . . . is . . . the ability to hold many points of view in suspension, along with a primary interest in the creation of a common meaning. . . . In the ordinary situation, consensus can lead to collusion and to playing false, but in true dialogue there is the possibility that a new form of consensual mind, which involves a rich creative order between the individual and the social, may be a more powerful instrument than is the

individual mind. Such consensus does not involve the pressure of authority or conformity, for it arises out of a spirit of friendship dedicated to clarity and the ultimate perceptions of what is true. In this way the tacit infrastructure of society and that of its subcultures are not opposed, nor is there any attempt to alter them or to destroy them. Rather, fixed and rigid frames dissolve in the creative free flow of dialogue as a new kind of microculture emerges. (p. 299-300)

Dialogue can lead to an individual's exploration of the nature and limits of knowledge and of one's way of being.

At the other end of the dialogue – deliberation continuum is deliberation. According to Daniels and Walker (2001), deliberation is the process of working collaboratively to find the best argument toward solution to the problem at hand. Daniels and Walker suggest that the process of moving from dialogue to deliberation is a generative process. This generative process is congruent with a transformative orientation to teaching and learning. In a collaborative planning context dialogue can lead to deliberation. Deliberation helps define the nature of the problem and its potential solutions.

Learners who are a part of a collaborative planning process and who experience transformation of meaning structures may come to different understandings based on their past experience, epistemology and ontology (Brown, 2006). Brown (2006) states, Rational discourse involves a commitment to extended and repeated conversations that evolve with time into a culture of careful listening and

cautious openness to new perspectives—not shared understanding in the sense of consensus but rather, deeper and richer understandings of our own biases, as well as where our colleagues are coming from on particular issues and how each of us differently constructs those issues. (p. 709)

Engaging in dialogue and deliberation may result in diverse solutions to wicked problems (Daniels & Walker, 2001). These authors posit that the continuum between dialogue and deliberation is one element that leads to action in collaborative planning processes.

Assessment of Learning

As noted earlier, there is the challenge of identifying the “phenomena about which to measure knowledge” (Deyle & Shively Slotterback, 2009, p. 26) and there is an added challenge of knowing how knowledge should be measured. The authors describe this as a challenge because it is difficult to know what to measure prior to knowing the content and outcomes of the collaborative process. Specifically, it is difficult to know what knowledge might account for the development of well-thought-out arguments supporting a plan of action before the participants begin working toward the development of a plan. It is not the objective of this research project to measure learning; however, one of the objectives of this study is to provide future researchers with ideas about what to measure. Identification of the variables of interest also requires knowing how to assess learning. Using constructs that represent ways of understanding is a beginning toward understanding the participants’ experience.

Wiggins and McTighe (2006) propose six constructs known as *facets of understanding* and they suggest ways to assess learning for each. While their

“understanding by design” framework has been developed for assessing students in formal education settings, the framework may have application to explaining a linkage between learning and action in collaborative processes. Wiggins and McTighe distinguish between the terms knowledge and understanding as described in the following statements, “An understanding is a mental construct, an abstraction made by the human mind to make sense of many distinct pieces of knowledge” (p. 37); “Understanding is thus not mere knowledge of facts but inference about why and how, with specific evidence and logic—insightful connections and illustrations” (p. 86). Wiggins and McTighe’s facets of understanding include explanation, interpretation, application, perspective, empathy, and self-understanding. To explain is to be able to use the phenomenon and facts available to answer why or how questions about the topic at hand, i.e., how the facts relate to each other and what inferences might be drawn. To interpret a phenomenon is to tell the story of the event or action. The use of scenarios in collaborative planning is the enactment of Wiggins and McTighe’s interpretation facet of understanding. The facet of application is the ability to use knowledge to solve problems. The facets of perspective and empathy are related and both are especially relevant to collaborative processes. Perspective is the ability to expose unexamined assumptions. Empathy is the ability to put aside that which one thinks one knows to hear other people’s voices on the topic at hand; it is the ability to view problems through another’s eyes. Finally, the facet of self-knowledge is an understanding of one’s own limits of knowing, ways of knowing and ways of being. Considering these facets of understandings in the collaborative planning process will provide a more nuanced approach to understanding

the connection between learning and action. Furthermore, the facets of understanding may provide a framework for exploring the participants' experience of learning in a collaborative process.

Transformative Learning and the Collaborative Process

Transformative learning offers a theoretical lens to exploring learning in a collaborative process. Transformative learning may produce changes in the participants' ways of making meaning in one or more ways including by, "elaborating existing frames of reference, by learning new frames of reference, by transforming points of view, or by transforming habits of mind" (Mezirow, 2000, p. 19). Transformative learning is a permanent change in cognition (Mezirow, 2000). It is a restructuring of mental models regarding one's ways of knowing and personal perceptions (Mezirow, 2009).

Transformative learning involves both the rational and affective thought processes (Taylor, 2009). Finally, transformative learning can lead to action (Mezirow, 1993, 2000; Mezirow, Taylor and Associates, 2009).

Taylor (2009) describes six core elements of transformative learning common to most transformative learning experiences. These include

- experience,
- critical reflection,
- dialogue,
- awareness of context,
- a holistic orientation, and
- authentic practice.

Taylor also notes that these elements are not a recipe for fostering transformative learning. An awareness of the inter-related nature of these elements is necessary for facilitating transformative learning.

There are two theoretical orientations to transformative learning: transformation for individual development and transformation for social change (Taylor, 2009).

Transformation for individual development is focused on individual growth.

Transformation for social change includes personal transformation and also has a focus on an awareness of one's own and others' perspectives in the context of a social issue.

From this orientation critical reflection involves the uncovering of assumptions about power, authority and the ability to change social norms and structures. The following subsections describe in more detail the core elements of transformative learning.

Experience, critical reflection and dialogue. Regardless of the orientation to transformative learning, Langan, Sheese and Davidson (2009) describe a cycle of learning that involves experience, reflection and dialogue.

Taylor posits that it is a combination of previous experience and the experiences associated with the learning itself that provides a basis for critical reflection and dialogue. However, it also takes a person who has developed an ability to think epistemically (Merriam, 2004). In regard to critical reflection Taylor states,

There are three forms of reflection in the transformation of meaning perspectives: content (reflecting on what we perceive, think, feel, and act), process (reflecting on how we perform the functions of perceiving), and premise (an awareness of why we perceive). Premise reflection, the least

common of the three and the basis for critical reflection, refers to examining the presuppositions underlying our knowledge of the world. (p. 7)

In summary, critical reflection is the ability to step beside one's own experience and examine the nature of knowledge: what is known, how it is known and what can be known (Taylor, 2009).

Critical reflection involves rational thought as well as emotions. Taylor (2009) states, "While critical reflection was at one time predominantly seen as a rational approach to learning, research has revealed that it is the affective ways of knowing that prioritize experience and identify for the learner what is personally most significant in the process of reflection" (p. 4). Kotter and Cohen (2002) also describe the internal cognitive process involving more than rational thought. They describe learning as a process of seeing, feeling and changing.

Dialogue can function as a catalyst for change. Dialogue includes the internal cognitive processes involved with reflection and discussion of the topic at hand with others. Dialogue as used here is congruent with Bohmian dialogue as presented earlier (Bohm, 2003a; 2003b).

Awareness of context, holistic approach and authenticity. Three additional elements common to transformative learning include context, holistic approach and authenticity (Taylor, 2009). Awareness of context includes the learning environment, the topic at hand, the temporal nature of the topic at hand and awareness of time constraints. Time constraints are recognized by Muro and Jeffery (2006) as a barrier to fostering learning in collaborative planning processes. A holistic approach considers various

capacities of learning. These capacities can be related to what Gardner (2004) identifies as linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, interpersonal, and intra personal intelligences or “abilities valued by human cultures” (p. 62). Authenticity refers to trusting, meaningful relationships between all participants--whether teacher and student, facilitator and participant, or researcher and subject (Taylor, 2009).

Transformative learning as a catalyst for action. Transformative learning can be a catalyst for social change (Mezirow, 1991b, 1993). In the context of collaborative planning, Daniels and Walker (2001) and Innes and Booher (1999) describe learning processes that transform the participants’ meaning perspectives. Transformative learning is considered to be uniquely an adult experience and those engaged in transformative learning have developed the ability to examine their own and others assumptions (Merriam, 2004). Mezirow (2009) suggests that transformative learning can occur outside a facilitated learning experience. Mezirow (1991b), based on his study of women returning to college, describes 10 phases in the transformative process. Quoting Mezirow (1991b) these include,

1. A disorienting dilemma
2. Self-examination with feelings of guilt or shame
3. A critical reassessment of epistemic, sociocultural, or psychic assumptions
4. Recognition that one’s discontent and the process of transformation are shared and that others have negotiated similar change
5. Exploration of options for new roles, relationships, and actions
6. Planning a course of action

7. Acquisition of knowledge and skills for implementing one's plans
8. Provisional trying of new roles
9. Building of competence and self-confidence in new roles and relationships; and
10. A reintegration into one's life on the basis of conditions dictated by one's new perspective. (p. 168-169)

A disorienting dilemma can be an experience that serves to focus one's thoughts on the content, process or premise of the subject at hand (Mezirow, 1991b, 1993, 2000, 2009, 2012). Items two through four involve personal reflection on the dilemma and comparison to one's past experience and items five and six often involve dialogue (Mezirow, 1991b). Items seven through nine may, in addition to dialogue involve deliberation on cause and effect (Daniels and Walker, 2001). These steps may or may not occur sequentially (Cranton, 2006). Also, change in meaning schemes or transformation of perceptions may occur rapidly, incrementally over time or after a delay of months or years. In summary, reflection, dialogue and deliberation can serve as catalysts for changes in perceptions and action.

Teaching as an Intentional Act

Deyle and Schively Slotterback (2009), as well as Muro and Jeffrey (2006), state learning may be an incidental benefit of collaborative processes. Why should learning, especially if as Innes and Booher (1999) posit that learning leads to action, be an incidental outcome of collaborative processes? How might being intentional about teaching for transformation be accomplished within an informal collaborative process?

To answer these questions this section examines the purposes of adult education, the role of the educator, different forms of group learning, and bricolage as transformative learning.

Transformative Adult Education

If transformative learning is to lead to action, then understanding how to facilitate transformative learning may be helpful. Mezirow (2000) states transformative education has as its goal the development of the individual so that the individual can independently decide their own actions in relation to the decisions and actions of others. The adult educator advocates for and supports the individual as the individual exercises agency within society (Mezirow, 2000).

In the education literature on adult learning, several authors have described the benefits of the educator becoming a learning helper or facilitator of the learning process, creating opportunities for discovery and opening the way for examination of problems through multiple perspectives (Franz, 2007; Gootee, Blatner, Baumgartner, Carroll, & Weber, 2010; Mezirow, 2000; Raison, 2010). A co-learner may also be an appropriate way to describe the role of the instructor in transformative learning (Mezirow, 2000).

Mezirow (2000) describes how facilitating transformative learning involves a way of being as a teacher. Transformative learning requires the facilitator to be authentic with participants, allowing them to form their own opinions. Participants transform, or not, based on their own experience and development. Since transformation of meaning structures is an emergent quality, one cannot teach for transformation, however one can provide time for and foster conditions conducive to transformation. In an informal

collaborative process the facilitator creates opportunities and time for transformation to occur. This is similar to the way the facilitator of collaborative processes encourages the social construction of knowledge through dialogue and deliberation. Innes (1996) describes the facilitator's role as framing the problems, bringing attention to issues, organizing the process, explaining the context, encouraging honesty and authenticity, and creating conditions for dialogue and deliberation. Drawing from Habermas, the conditions needed for discourse include "having complete information, being free from self-deception, being able to evaluate arguments objectively, having empathy" (Merriam, Caffarella & Baumgartner, 2007, p. 134) and having freedom from "distortions by power and influence" (Mezirow, 2000, p. 14).

Learning and Social Learning

Mezirow (2000) defines learning as "the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one's experience as a guide to future action" (p. 5). In an effort to better understand the process of learning, Cranton (1996) describes three forms of group learning: cooperative learning, collaborative learning and transformative group learning. Cooperative learning produces knowledge about things or how to solve a problem. The focus of cooperative learning is on the topic at hand and problem solving. The teacher's role is to provide the content and define the learning activities. Collaborative learning is the creation of knowledge-based communication between the group's participants and application of that knowledge in real world contexts (Cranton, 1996; Daniels and Walker, 2001). The role of the instructor is to define the learning experiences and facilitate the process. Transformative group

learning extends beyond collaborative learning to include the formation of new meaning schemes and perspectives through reflection and interaction with others. The role of the instructor is as a co-learner. Based on Deyle and Shively Slotterback's (2009) research regarding learning in the collaborative planning process and reports by Innes and Booher (1999), all three forms of learning occur in collaborative processes.

Reed et al. (2010) provides a critique of the use of social learning to address wicked problems. They suggest that

- social learning has become the norm in natural resource management;
- the definitions of social learning used in natural resource management have conflated the collaborative process with learning itself; and
- clarity in how individual learning links to action is needed.

Further, they propose social learning be defined as a change in how participants understand the issue at hand and that the change in understanding “become[s] situated within the wider social units or communities of practice within society” (Reed et al. 2010, conclusion).

Bricolage and Transformative Learning

Innes and Booher (1999) state, “Planning through consensus is not just communication, but learning” (p. 13). They also suggest the planning processes that result in action do so via a nonlinear, emergent reasoning process called bricolage. Bricolage produces new ways of framing the situation and enables the creation of new options or variables that were not part of the original mental models. Bricolage, according to Innes and Booher, is a way to move from Argyris' single loop learning to

double loop learning. Single loop learning focuses on understanding the issue at hand so that adjustments can be made to address the issue and allow the system to function more effectively within the constraints of the mental models held about the system (Argyris, 2004). Double loop learning focuses on the creation of new mental models or variables within the context of the system of interest. Double loop learning transcends the constraints of the mental models held by the participants. Thus double loop learning is the ability to examine perceptions, suspend assumptions and explore new solutions to catalyze change in the variables that govern the program theory in use. Innes and Booher suggest that bricolage leads to transformation of meaning structures and learning. They state, bricolage produces

A new way of framing the situation and of developing unanticipated combinations of actions that are qualitatively different from the options on the table at the outset. The result of this collective tinkering with new scenarios is, most importantly, learning and change among the players, and growth in their sophistication about each other, about the issues, and about the futures they could seek. (p. 12)

Innes and Booher (1999) contend that consensus building can be understood as a process of transformative learning; in this process participants are at their most creative when they assume new roles and identities in the deliberation of emerging contingencies that arise while addressing complex social issues. Consensus building as defined by Innes and Booher encompasses "processes in which individuals representing differing interests engage in long-term, face-to-face discussions, seeking agreement on strategy, plans,

policies, or actions" (p. 11). The process of consensus building is an intentional one where the role of the facilitator is to ensure equality among participants using techniques that allow all participants to be heard in the process of respectful discussion.

While the type of learning described by Innes and Booher (1999) may occur without intentional efforts to foster its occurrence, Taylor (2009), in reference to transformative learning, notes, "it often requires intentional action, personal risk, a genuine concern for the learners' betterment, and the ability to draw on a variety of methods and techniques that help create a classroom environment that supports personal growth and, for others, social change" (p. 14). In essence, engaging learners effectively is an intentional act and, whether in a collaborative process or a classroom it involves a specific way of being as a teacher. This way of being has a focus on the social construction of knowledge and is in contrast to the philosophical concept of positivism which underlies the expert model of education.

Transformative Learning, Collaborative Processes and Social Constructivism

Interest in social learning and its application to Extension and to collaborative processes has been documented by Bruffee (1993), Innes (1996), Jordan, Niemi-Blissett, Simmons, White, Gunsolus, Becker and Damme (2005), and Raison (2010). Social constructivism, a philosophical concept underlying social learning, provides a common background for transformative learning, consensus building and collaborative processes (Innes, 1994; Daniels & Walker, 2001). Adopting a social constructivist approach in the facilitation of collaborative processes and in teaching frees participants from the constraints of the expert model and makes the participants responsible for their own

learning. Participants who are responsible for their own learning are free from coercion and can take action based on their own volition.

Collaborative processes and transformative learning theory also have common roots in Habermasian communicative rationality. Innes (1996) states,

Communicatively rational decisions, then, are those that come about because there are good reasons for them rather than because of the political or economic power of particular stakeholders. For these processes to be truly communicatively *rational*, they must also reflect "emancipatory knowledge," or knowledge of the deeper reality hidden behind popular myths, scientific theories, and the arguments and rationalizations in common use. Such knowledge can come through dialectic, self-reflection, praxis—the broad and deep experience of those who know how to do things in the world—and from discourse that challenges prevailing assumptions. (p. 461)

Experience, including existing knowledge, beliefs, culture, personal perceptions and world views, provides a foundation for the social construction of knowledge (Bransford, Brown, & Cocking, 2000). The social construction of knowledge is a reflexive, recursive, and reciprocal process between participants, content, and experience. For a social constructivist, truth is not fixed; rather, truth is created from shared meanings. Kuhn (1962), in writing about scientific knowledge, compares knowledge to language and states that knowledge "Is intrinsically the common property of a group or else nothing at all" (p. 209).

Epistemology, Ontology and the Social Construction of Knowledge

Changes in a person's views of the nature and limits of knowledge or epistemic cognition, as well as changes in one's identity, ways of being or ontology, can result from teaching and learning experiences based on the social construction of knowledge. Packer and Goicoechea (2000) suggest that social constructivist approaches are based in both epistemology and ontology. Epistemology has to do with the relationship between the knower and the known, as well as the nature and limits of knowledge. Ontological awareness is based on culture and history. Participants of a community construct knowledge and act on that knowledge in relation to the culture of the community and social norms.

Three Levels of Cognition

Understanding how researchers have described cognition to explain human thought provides a frame of reference to begin exploration of the links between learning and action. Kitchener (1983) proposed a three level model of cognition: cognition, metacognition and epistemic cognition. She explained how the definition of metacognition was often confused with epistemic cognition. This distinction is important to gaining a better understanding of what it means to learn. Level one, cognition, involves learning about things and understanding facts and figures to communicate about the issue at hand. Level two, metacognition, utilizes both level one processes and learning about what processes should be applied to solve problems. Metacognition also involves the monitoring of one's thoughts regarding the issue at hand. Level three, epistemic cognition, utilizes both levels one and two and "has to do with reflections on the limits of

knowledge, the certainty of knowledge, and the criteria for knowing" (Kitchener, 1983, p. 230). The limits of knowledge refer to what can be known; the certainty of knowledge is about the probability of knowing for sure; and the criteria for knowing involves what constitutes knowledge and by whose authority it is accepted as knowledge. Kitchener defines epistemic cognition as follows: "It is knowledge of whether our cognitive strategies are sometimes limited, in what ways solutions can be true, and whether reasoning correctly about a problem necessarily leads to an absolutely correct solution" (p. 226). The ability to utilize epistemic cognition is necessary to solving wicked problems and necessary to transformative learning (Kitchener, 1983; Merriam, 2004; Salner, 1986).

While Johnson (2010), in an investigation of scenario planning, found the connection between epistemic knowledge and action elusive, Bawden (1998), Bawden and Reichenbach (2010), and Innes and Booher (1999) posit that changes in epistemic knowledge occur and lead to changes in how people act. In the context of collaborative planning, Daniels and Walker (2001) posit that communication is the means used to socially construct shared understandings and that it is from shared understandings that a group can begin the process of dialogue and deliberation leading to taking action. Kitchener (1983) posits that the ability to think epistemically is necessary to both finding solutions to ill-defined problems, making decisions and taking action.

Cognitive Development

The ability to think epistemically and systemically has also been related to cognitive development (Salner, 1986). In a longitudinal study investigating cognitive development in adults, Perry (1968) developed a nine-stage theory of epistemic cognition. To simplify this theory, the nine stages can be reduced to three: dualism, multiplicity and contextual relativism. Dualism is a form of development characterized by absolutes. There is one right and wrong way of doing; the knower and the known are separate. The source of knowledge in the dualistic stage is external to the learner. Multiplicity is the stage where pluralism is accepted, i.e., there are multiple ways of knowing. According to Perry, as the learner encounters ideas that are different, many ideas about truth emerge. Salner (1986) notes that at this stage the learner is likely to say, “That’s how you see it, this is how I see it.” The source of knowledge in the multiplistic stages is found within the learners. The contextual relativism stage of Perry’s theory involves an “increased awareness of the importance of contexts in defining truth and value” (Salner, p. 226). Both Salner and Perry believe that truth is found in the interaction of the other and the self. Perry notes it is at this stage that the learner begins to take on responsibility as an actor in society. Salner describes the theory as a “structural reorganization of epistemic assumptions in the direction of increasing complexity. This reorganization takes place on an individual time table as a result of confrontation with social and intellectual changes which must be resolved” (Salner, p. 227).

The Reflective Judgment Model of Cognitive Development

King and Kitchener (2004) describe the construct of reflective thinking as originating with Dewey, “who argued reflective judgments are initiated when an individual recognizes that there is controversy or doubt about a problem that cannot be answered by formal logic alone” (p. 6). Similar to Perry’s stage theory of epistemic cognition, the Reflective Judgment Model (RJM) explains cognitive development in stages. The stages in the RJM are frameworks for explaining the process of development, though they do not “constitute an invariant sequence that exists across all cultures” (King & Kitchener, 2004, p 10). These authors further describe reflective judgment as “a central goal of education, especially higher education” (2004, p. 6).

To introduce RJM, King and Kitchener (2004) group the RJM’s seven stages into three: pre-reflective thinking, quasi-reflective thinking, and reflective thinking. The authors describe the transition between pre-reflective thinking and quasi-reflective thinking as a shift from thinking that knowledge is fixed, all problems are well structured and arguments are defended by reference to authority, toward thinking that knowledge is relative. The transition between quasi-reflective and reflective thinking involves a shift from a relativistic view toward one where knowledge is synthesized from diverse and often opposing viewpoints. Both Perry’s stage model and RJM have import to the study of collaborative planning processes. For example, if the participants in a collaborative planning process are quasi-reflective thinkers, the link between learning and action may not be obvious as the participants may not be able to reflect on the connection; thus they may be unable to report how learning links to action.

Mezirow's Transformative Learning Theory

Mezirow's transformative learning theory is used as a lens to understand the participants' experience of learning and the links between learning and change in perceptions. As previously presented, the transformative learning process involves the participants' previous experience, reflection on the topic at hand and dialogue. The three types of reflection—content, process and premise—are useful constructs for the exploration of transformative learning (Cranton, 2006). Content reflection asks questions about the facts. Process reflection asks questions about cause and effect. Process reflection is reflection on one's thought processes. It requires the ability to engage in metacognition and epistemic cognition. Premise reflection asks, "Why?", "What should be?" and "What is good or beautiful about the topic at hand?" These are questions about the nature of truth, and how one knows the truth (Mezirow, 1991b; Cranton, 2006). The opportunity and ability of participants in a collaborative planning process to engage in all three forms of reflection is likely to have an impact on learning and action. Packer and Goicoechea (2000) and Mezirow (1993) suggest that the underlying motivations for action may be related to a participant's implicit epistemic and ontological assumptions. Further, they consider epistemological knowledge as being socially constructed and that one's ontological stance is influenced by social and cultural norms. However, Stedman (2003) suggests that a view of ontology as strictly being influenced by socio-cultural influences is misleading. Stedman states that a person's way of being can also be socially constructed. Thus the relationship between epistemic and ontological knowledge is reflexive and recursive. Because of this relationship it may be difficult to distinguish

between a participant's reflection on content and reflection on process. Transformative learning results in changes to epistemological and ontological ways of knowing thus affecting how experience is understood and delimited. These changes also affect how judgments are made and ultimately what actions might be taken in reference to the issue at hand.

Social Learning in Natural Resources

Rodela (2013), in a survey of 97 papers using social learning in natural resource management, found 81 provided empirical data for social learning and 16 provided a conceptual analysis social learning. These papers were organized by the seminal writers in the fields of adult education and policy sciences. In her conclusion Rodela (2013) suggests using existing theories of learning to understand how the process influences learning and leads to desired outcomes. She states,

Most of the research reported in the selected publications does not take aspects of research design into account and performs a type of selective borrowing in which established learning theories are used most to justify newly designed conceptual frameworks, rather than verifying assumptions advanced at the outset. This is certainly a legitimate choice; borrowing can be performed in many ways and serve very different purposes. However, if we aim to improve the understanding of learning processes in a resource-management context, the integration of questions that touch upon what counts as proof of learning and how learning can be operationalised [sic] could offer new opportunities. Only a limited number of the selected publications reported on research that operationalised [sic] learning

by integrating established knowledge within the domain from which the authors borrowed concepts/methods. (Rodela, 2013 p. 164)

This study adds to the growing body of literature that links the characteristics of the learning environment to social learning by providing a description of what participants experienced and providing evidence of change in participant perceptions.

Social learning and research into the use of social learning in natural resources has been described in the literature in a number of ways. My research fits the “individual-centric” model described by Rodela (2011). The individual-centric model rests on the work of various authors including Freire, Habermas, Kolb, and Mezirow (Rodela, 2013). I have used transformative learning theory to understanding individual learning in the group environment and thus provide additional insight into the social learning process.

Why Transformative Learning Theory?

Transformative learning theory offers insight into the relationship between individual change, and collective action. Literature on the collaborative process often references Habermas’ communicative action theory (Rodela, 2013). Transformative learning theory builds on Habermas’ communicative action theory to explain individual learning (Mezirow, 1991b). Because of this common thread it seems reasonable to use transformative learning theory as a lens. Further, the selection of a single theory to verify learning and explore the characteristics of the learning environment provides consistency in exploring the linkages between learning and action.

Gaps in the Education Literature

In the education literature, while numerous studies have described the characteristics of the environment that foster transformative learning and these have been conducted in a wide range of disciplines, few studies have examined transformative learning in the context of collaborative processes or social learning (Taylor & Snyder, 2012). Lankester (2013) conducted a study titled *Conceptual and Operational Understanding of Learning for Sustainability: A Case Study of the Beef Industry in North-Eastern Australia*. Regarding the need for more detailed studies, she states, “Future extension programs that aim to enhance sustainability may be more effective with an increased understanding of the internal processes of individuals’ learning and how these processes influence changes in self-identity.”

While there is an increasing amount of educational literature specific to examining the characteristics of the learning environment that foster transformational learning, Taylor, Cranton and Associates, (2012) call for additional studies. E. W. Taylor in a personal communication, suggested that longitudinal studies of transformative learning are uncommon and also suggested exploring the relationship between collaborative processes and transformative learning (December 6, 2012). He specifically asked, “Is there something unique about people working in a collaborative setting?” and “What is the relationship between people with diverse backgrounds?”

Summary

This study focuses on the relationship of the collaborative planning process to individual transformative learning; the findings increase our knowledge of the

characteristics of the learning environment which foster transformative learning in the context of collaborative and social learning processes. This study also extends the current conception of transformational learning theory by describing how participants use deliberation and dialogue to vet new ideas.

Chapter 3 -- Methods

Research examining the links between learning and change in how participants view biomass production was conducted in conjunction with the Seven Mile Creek Fuelshed Project (SMCFP). I was invited to be a part of this project by Nicholas Jordan, the principle investigator of the SMCFP (see Appendix A). The SMCFP used an informal collaborative process to allow participants to assess options for increasing biomass production in anticipation of an ammonia fiber expansion facility (AFEX). This project was expected to and did challenge participants' viewpoints about what might be grown in the agricultural landscape. It also provided participants with the opportunity to explore biomass production as well as the potential impacts the project might have on farm income, water quality and habitat. The project location was the Seven Mile Creek watershed near St Peter, Minnesota, United States. The collaborative process involved eight, four to six hour workshops. These workshops began in June of 2013 and were held roughly once per month until March of 2014.

Problem Statement

This research explored educational practice in the context of a collaborative process examining a wicked problem. Wicked problems have been defined by Rittel and Weber (1973) as problems which are complex, contestable and resistant to change. Adapting to climate change is one example.

The research results are expected to benefit educators who use informal collaborative processes in teaching, facilitators of collaborative planning processes, workers in boundary organizations and researchers conducting action research. Boundary

organizations are those organizations that work at the intersection of paradigms.

Boundary work, the work of boundary organizations, is described by Clark et al. (2011) as work focused on the intersection of science and policy and more broadly as work connecting knowledge and action. This research builds upon understanding of boundary work. This research also sets the stage for future studies regarding learning, change in perception and change in action by identifying and describing the potential links between learning and action through the lens of educational theory.

Research Questions

In the context of the SMCFP, this research addressed the following research questions:

1. What are the participants' experiences with collaborative processes?
2. What are the participants' experiences regarding transformative learning?
3. What are the links between transformational learning and changes in participants' understanding of agriculture in the Seven Mile Creek Fuelshed Project?

Research question one emerged from the first round of interviews. During the first interview, participants asked for a definition of a collaborative planning process: I responded by asking them their definition and seeking to learn what elements are important to collaborative processes from the participants' point of view.

Research Methodology

The approach used in this study is based in social constructivism and rests on the assumption that participants create their own perceptions and understanding of knowledge through interaction with others. Learning in this context is not about the accumulation of facts; learning is about how the participants make and apply meaning to address the issue at hand.

Kuhn (1962) writes about knowledge being communal and created in a social context. Daniels and Walker (2001) describe learning in a communal or collaborative process as collaborative learning. Regarding the assumptions made about collaborative learning Bruffee (1993) states,

Collaborative learning assumes instead (as opposed to foundational knowledge) that knowledge is a consensus among the members of a community of knowledgeable peers -- something people construct by talking together and reaching agreement. . . . Collaborative learning is a reacculturative process that helps students become members of knowledge communities whose common property is different from the common property of the knowledge communities they already belong to. (p. 3)

A case study design was used to explore the links between learning and change. Yin (2009) describes case studies as being used when the researcher desires a holistic insight into real-life events and behaviors. He defines the case study as, "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context" (p. 18).

Transformative Learning Theory as an Analytic Framework

The lens used to study the participants' experience of learning in the SMCFP is Mezirow's (1991b, 1993, 2000, 2009, 2012) Transformative Learning Theory. When assessing transformative learning, Mezirow (1991b) suggests looking for changes in participant expectations, goals, and sophistication of dialogue.

Mezirow (1991b) states that transformation can occur in any of the learning domains described by Habermas; instrumental, communicative or critical. Further, Mezirow posits transformation occurs because of a disorienting dilemma, reflection on content, process or premise, dialogue or vetting of the new-found knowledge, and re-integration of new ideas back into one's life. The process of reflection and dialogue may result in changes in meaning schemes or meaning perspectives. Meaning perspectives include our view of the world. According to Mezirow (2000, 2009, 2012) meaning perspectives are defined by six habits of mind:

- Aesthetic –what is beautiful,
- Epistemic – what is true,
- Moral-ethical – judgments about ways to act in relation to others,
- Philosophical – unifying normative principles such as religion,
- Psychological – related to human development, and
- Socio-linguistic – a way of being influenced by language and culture.

Mezirow (1991b) describes meaning perspectives as being expressed through meaning schemes which include attitudes, beliefs and values. Mezirow describes meaning schemes and meaning perspectives, collectively known as meaning structures, as being tacit unless

the process of reflection and dialogue make them explicit. Changes in meaning schemes may be more common than changes in meaning perspectives (Mezirow, 1991b, 2000).

Research Design Overview

To provide context to data collected, a logic model was developed for the SMCFP and for each of the workshops. Table 1 is a logic model for the entire SMCFP and Appendix B contains the logic models for each workshop. The first three workshops were designed to provide expert information on the AFEX process, how biomass might be produced and the impacts to economics, water quality and wildlife habitat. Workshop four was designed to provide participants with the opportunity to reflect on and discuss what they had learned in the context of their own experience. Workshop five introduced the geo-design tool. Workshops six, seven and eight allowed participants to work with the geo-design tool to explore options for biomass production. The geo-design tool provided real time outputs on economics, water quality measures and habitat. Each workshop agenda is included in Appendix C.

Table 1

Logic Model for the Seven Mile Creek Fuelshed Project

Situation	Opportunities	Goals why the project exists	Inputs	Activities	Outputs and Outcomes
<p>Limited markets for biomass.</p> <p>Interest in diversity of farm production, farm productivity and resource efficiency, while reducing the harmful effects of agro-ecosystems.</p> <p>Why Seven Mile Creek? There are existing data sets based on research.</p>	<p>Opportunity to discuss options for multifunctional agriculture.</p> <p>The ammonia fiber expansion facility (AFEX) is a catalyst for discussion.</p> <p>How might an AFEX facility increase economic opportunity, increase environmental quality and increase habitat value?</p>	<p>An interest in improving economic opportunity for farmers while reducing environmental problems.</p>	<p>The research team: Nick Jordan, Agronomy & Plant Genetics; Carissa Shively Slotterback, Humphrey School of Public Affairs Cindy Zerger, Humphrey School of Public Affairs David Mulla, Soil, Water & Climate David Pitt, Landscape Architecture Mike Reichenbach, U of M Duluth Doctoral Candidate & U of M Extension</p> <ul style="list-style-type: none"> • Team member passion around multifunctional agriculture. • A vision for how informal collaborative processes can create common understanding, leading to action around controversial issues. • A diverse group of participants. • Access to research based data. • A geo-design tool used to help participants design and vet ideas for landscape change. 	<p>Eight workshops.</p> <p>A transdisciplinary research team, with an interest in exploring the biomass production and multifunctional agriculture and in helping others explore these ideas.</p> <p>Use of a geo-design tool.</p> <p>The development of potential scenarios</p> <p>The vetting and comparison of scenarios against performance measures</p>	<p>A process that provides opportunities for learning.</p> <p>Change in how agriculture is viewed.</p> <p>Participants will gain a better understanding of the outcomes and impacts of biomass production in relation to economics, water quality and habitat</p> <p>Analysis of the process by the investigators and set up for implementation of examination of the supply chain and community sustainability as phase II.</p>

Credibility and Trustworthiness

Transformational learning theory has a history of use in educational research and case study design (Mezirow, Taylor and Associates, 2009). To build credibility, multiple sources of evidence, including interviews with multiple participants, researcher' journals, a focus group and observation were used to provide for multiple views of the same phenomenon.

To address trustworthiness, the analysis of the data considered alternative learning theories and ideas from informal collaborative processes including Bawden's (1998) inspirational learning and Daniels and Walker (2001) collaborative learning.

An additional element of trustworthiness has to do with theoretic or analytic generalization (Creswell, 2007; Yin, 2009). Yin (2009) states that case study findings are "generalizable to theoretical propositions" (p. 15). The findings in this study are not to be generalized to a larger population as is the case with quantitative research; rather the case study demonstrated how the theoretical lens might or might not be applicable to similar contexts.

The Participants

For the purpose of this study, the term participant is used as a synonym for stakeholder. Jiggins (2004) suggests a stakeholder is one who, as a result of participation, has an interest in the outcome of the collaborative planning process. More specifically he states,

A person or group is not a stakeholder *simply by asserting a claim* but becomes a stakeholder through participating in stake-holding *processes*

that construct the nature of the stakes and the relationship among stakeholders. Debate, negotiation, dialogue, joint research, and the development of a “platform” or social space where stakeholders interact, are seen as key elements in such processes. (Jiggins, 2004, p. 33)

To obtain between 15 and 25 participants the research team developed a list of 137 potential participants from people known to have an interest in the agricultural landscape. Potential participants included

- employees of natural resource and conservation policy organizations,
- natural resource, planning and conservation government agencies,
- farmers and farming organizations, and
- educators employed in higher education.

Table 2 provides details about participation by these groups for all participants. This list of potential participants was reviewed and reduced to 71 potential participants based on their proximity to St Peter, Minnesota, and their availability. If potential participants did not live or work in Nicollet County, they were excluded from the list. Each of the 71 participants was sent an invitation email and project description (see Appendix D and E). To answer questions and confirm participation, a follow-up phone call was made to each of these potential participants. All potential participants were adults with an interest in agriculture or natural resources.

Human Subjects Protection

Application was made to the University of Minnesota Institutional Review Board for two separate reviews. An application was made by the research team principle

investigator, Nick Jordan, for research exempt from IRB committee review, Category 2, surveys, interviews, standard education tests and observations of public behavior for the SMCFP as a whole. The letter showing approval and the consent form are in Appendices F, and G. An application was also made by me as a researcher for research exempt from IRB committee review, category 2, for the collection of research team member journals. The letter showing approval, the application and consent form are in Appendices H, and I.

My Role as a Researcher

My role as a member of the research team was to assist in workshop design, comment on the process and assist with each workshop. My role as a researcher exploring the links between learning and change was as an observer. Although the research component of this project was to operate in the background, there were interactions between myself, the other researchers and the participants. Lowes and Prowse (2001) state, “the products of a phenomenological interview are ‘co-created’ by both interviewer and respondent -- products of human interaction where each one has an effect on the responses of the other” (p. 174). These interactions were an expected part of this research.

Table 2

Participant Workshop Attendance, Affiliation and Interview Status

	Interview			Workshop								Workshops
Code	1	2	Affiliation	1	2	3	4	5	6	7	8	# attended
G2	Yes	Yes	Policy ngo		0	0	0	0	0	0	0	7
F2	X	--	Policy ngo		0							1
G1	X	--	Policy ngo	0								1
I2	--	--	Policy ngo			0	0	0	0	0	0	6
K2	--	--	Policy ngo						0			1
L1	Yes	Yes	Policy ngo	0	0	0		0	0	0	0	7
M1	Yes	Yes	Policy ngo	0	0	0	0	0	0	0	0	8
P1	Yes	--	Policy ngo	0	0	0		0	0			5
# of policy participants				4	5	5	3	5	6	4	4	
A1	Yes	--	Government	0					0	0	0	4
A2	X	--	Government	0					0	0		3
B2	X	--	Government	0								1
D2	X	--	Government	0								1
H1	X	--	Government		0			0		0		3
I1	X	--	Government	0								1
L2	--	--	Government							0	0	2
N1	Yes	Yes	Government	0	0		0	0		0		5
Q1	Yes	--	Government	0	0	0						3
S1	Yes	--	Government	0		0	0	0	0			5
T1	Yes	--	Government	0	0		0				0	4
U1	Yes	Yes	Government	0	0	0	0	0		0		6
W1	Yes	--	Government	0								1
Z1	Yes	--	Government	0		0		0		0		4
R1	Yes	No	Government	0	0	0		0	0	0	0	7
# of agency participants				13	6	5	4	6	4	8	4	
B1	Yes	--	Farming interest	0	0							2
C2	Yes	Yes	Farming interest	0	0	0			0	0	0	6
H2	--	--	Farming interest					0			0	2
I3	--	--	Farming interest				0	0				2
K1	X	--	Farming interest	0								1
N2	--	--	Farming interest			0						1
O2	--	--	Farming interest							0		1
P2	--	--	Farming interest							0	0	2
V1	Yes	Yes	Farming interest	0			0	0	0	0	0	6
# of farm interest participants				4	2	2	2	3	2	4	4	
E2	Yes	--	Higher ed		0			0	0			3
F1	Yes	--	Higher ed		0							1
J1	Yes	Yes	Higher ed	0		0	0		0	0	0	6
O1	Yes	--	Higher ed	0	0	0	0	0	0			6
X1	Yes	--	Higher ed	0	0	0	0	0	0			6
Y1	X	--	Higher ed	0								1
# of higher ed. participants				4	4	3	3	3	4	1	1	
Total # of Participants				25	17	15	12	17	16	17	13	

Note. Bold italics -- female participants; "O" -- attended; Dashes -- did not meet the criteria to be selected for an interview; "X" not a full participant; "No" --declined.

Information and Data Collection

A single case study design and qualitative approach were used to examine the links between learning and change in meaning schemes and meaning perspectives of individual participants. To answer the research questions, several data sources were used including

- interviews of participants,
- a focus group,
- researcher journals,
- my observation notes, and
- artifacts produced as part of the process.

Table 3, describes the data sources and timing of data collection.

Table 3

Data Sources and Timing of Data Collection

Data source	Timing
Interviews.	Between the 1 st and 3 rd workshop 21 participants were interviewed. After the collaborative planning sessions were completed eight participants were interviewed.
Focus group	A focus group was held immediately after the final workshop.
Documents and Artifacts	After the approval from IRB, through the end of the project.
Research team journals	Qualtrics was used to allow members of the research team to record their observations. Following each workshop, a notice to complete journal entries was sent to all research team members.
My observations	My observations were recorded throughout the research project.

Data from participants were collected via two rounds of interviews and one round of focus groups. The unit of analysis was the participant. The first round of interviews focused on participant expectations and experiences with collaborative processes.

Twenty-one first round interviews were conducted after the first and before the fourth workshop. Those persons selected for interviews must have attended either the first or second session and indicated they would be participating in future workshops. Interviews were between 20 and 40 minutes long and were conducted in person or by telephone. The interview guide for the first round of interviews is in Appendix J. Notes were taken during all interviews. All participants were asked if their comments could be recorded. One participant, R1, preferred not to be recorded. All recorded interviews were transcribed by a paid transcriptionist. Summaries of the interview transcripts were made using the listening method, as described later in this chapter (Gilligan, Spencer, Weinberg & Bertsch, 2003), and these summaries were sent to participants for their review and comment. Eighteen of 21 participants responded to indicate the summary accurately depicted their thoughts. Three participants, B1, Q1 and Z1 did not comment on their summaries. The data from all summaries were reviewed and used in analysis. The findings were based on both summaries and a review of the original transcripts.

Eight second-round interviews were conducted following the conclusion of the final workshop in March. One person declined to be interviewed. These interviews focused on what was learned, what facilitated participant learning during the process, and whether expectations were met. Second-round participants must have attended five or more workshops with at least one from June or July workshops, one from August or September workshops, one from October or December workshops and one from January or March workshops. These criteria were developed as a means to select those persons who had attended a representative cross section of the SMCFP. These interviews were

conducted via telephone, recorded and transcribed by a paid transcriptionist. Second-round interviews were 20 to 40 minutes in length. Due to research time constraints and participant fatigue, the summaries developed from the transcripts were not provided to participants for review. The interview guide for the second round of interviews is in Appendix K.

Two 30 minute focus groups of five persons each were conducted at the end of the final stakeholder meeting. Three participants who attended the March 7 workshop, A1, G2 and T1, could not stay for the focus group. The focus groups prompted participants to reflect on their experience of the informal collaborative process. I facilitated one focus group with the assistance of a research team member; two other research team members conducted the other focus group. These focus groups were recorded and transcribed. The participant codes were used to identify the participants. A summary of the transcripts was not made; instead, the transcripts were used as the data source. The guiding questions for the focus group are in Appendix L.

The research team members' observations and thoughts about the process were requested at the end of each workshop. A guide for journaling was developed using Qualtrics. This was intended to focus the researchers' comments on the learning that occurred, what facilitated the learning and what might need to be changed for the next workshop. A copy of the journal guide is in Appendix M. The research team was also given the option of responding by email. The research team journals served to provide context to the data obtained from the interviews and focus groups. Follow-up with research team members to encourage completion of the journal was not conducted. The

response from the research team provided rich contextual descriptions of the learning that was occurring.

Data Analysis

A phenomenological approach was used to understand the participants' experience. The meaning of the participants' experience is derived from "the blend of the researcher's understanding of the phenomenon, participant-generated information, and data obtained from other relevant sources" (Wojnar & Swanson, 2007, p. 175). The method I chose for summarizing was termed "the listening method" by its authors and recognizes voice (who the person speaking is) and relationship (Gilligan, Spencer, Weinberg & Bertsch, 2003). The listening method involves listening to or reading the transcripts several times. The first time through the transcripts I listened for a plot and the general story or response to the interview questions. The second time I listened to the participants' voices. This involves how the participants use the first person pronoun, "I". I then listened with a specific focus on the research questions. From my notes and underlining I summarized what I had heard. Appendix N contains an example of the notes taken while using the listening method. I organized the summaries into sections, beginning first with an introduction to each participant and then sections detailing their responses to each research question. Each summary was sent to participants as a member check. All comments and changes were incorporated into a final version of the summary. The summary was used in two ways: 1) I re-read and wrote an interpretation using transformative learning theory as a lens; and 2) I read the summaries for emergent themes using research question one and research questions two and three as guides. In finding

emergent themes I focused on the research questions, and the key elements of transformative learning theory.

For research question one, the process of finding themes might be compared to open coding. For research question two and three, the process of finding emergent themes iterated between an open and closed “coding” methodology. The closed codes or themes used were the facets of learning as described by Wiggins and McTighe (2006). The development of themes produced two tables: one relates to the participant experience of the collaborative process and one relates to the participant experience of learning. Tables of emergent themes listed by participant code for each interview by research question one and two are in Appendices O, and P. The findings came out of a review of the summaries using Mezirow’s Transformative Learning Theory as a lens. These findings are described in the next chapter.

Summary

Characteristics that foster transformative learning were investigated as part of the Seven Mile Creek Fuelshed Project, a research project which engaged participants in a collaborative process regarding landscape change in a highly productive farming region of south central Minnesota, United States. The participant experience of the process was explored through analysis of data from observation, interviews and focus groups. This research used Mezirow’s (1991b, 1993, 2000, 2009, 2012) transformative learning theory as a lens.

Chapter 4 -- Findings

A single case study approach was used to explore the links between learning and action in the Seven Mile Creek Fuelshed Project. The project used a collaborative process to explore options for changing agricultural practice based on the introduction of an Ammonia Fiber Expansion (AFEX) biomass utilization process. This process has the potential for increasing economic options for farmers interested in utilizing corn stover and planting perennial grasses. The introduction of perennial grasses for biomass production also has the potential to reduce water pollution and increase wildlife habitat.

This research uses Mezirow's (1991b, 1993, 2000, 2009, 2012) transformative learning theory as a lens for exploring the individual participants' experience. This research is expected to contribute to the field of adult education by helping adult educators improve their practice, to contribute to boundary organizations by helping these organizations address intractable natural resource issues, and to contribute to action research by improving the facilitators' understanding of the participants' experiences of learning. For all of these groups, understanding how collaborative learning processes link to changes in participant perspective and thus to social change may be beneficial.

Mezirow (1991b) states, "Research in transformative learning focuses upon the process of rationality – of how reflective thought, discourse, and action come into being and what their consequences are" (p. 222). The process used is emergent and findings presented are provisional (Mezirow, 1991b). When assessing transformative learning Mezirow suggests looking for changes in expectations, goals, and the sophistication exhibited regarding the topic at hand.

The findings were analyzed and are organized around the following research questions;

1. What are the participants' experiences with collaborative processes?
2. What are the participants' experiences regarding transformative learning?
3. What are the links between transformational learning and changes in participants' understanding of agriculture in the Seven Mile Creek Fuelshed Project?

Between the first and third workshop, twenty-one participant interviews were conducted. At the last workshop a focus group was conducted. After the last workshop eight participant interviews were conducted. The interviews were transcribed and summarized using the listening method as described in "On the Listening Guide: A Voice-centered Relational Model" by Gilligan, Spencer, Weinberg, & Bertsch (2003). Open coding was used to find themes in the data for the participant's experience of the collaborative process (see Appendix O). Closed and open coding was used to find themes in the data for the participant's experience of learning (see Appendix P). Wiggins and McTighe's (2006) facets of understanding were used as means to understand learning. The names of all participants have been replaced by code designations A1, B1, and so forth. The names of the researcher team members have been replaced by RT1, RT2 . . . RT6.

This chapter presents the findings for research question one, and then presents the findings for research questions two and three. The four findings for research question one are summarized as follows:

1. What are the participants' experiences with collaborative processes?
 - a. Participants expected to have complete and credible information about the topic and objective.
 - b. Participants expected to be able to learn about the AFEX process and make rational judgments about the production of biomass. The legitimacy of the judgments made is determined by the participants.
 - c. Participants expected the opportunity to participate through dialogue and to listen and learn from others during the collaborative process.
 - d. Participants bring a predefined proclivity toward learning or openness to learning and the collaborative process.

The three findings for research questions two and three are summarized as follows:

2. What are the participants' experiences regarding transformative learning?, and
3. What are the links between transformational learning and changes in participants' understanding of agriculture in the Seven Mile Creek Fuelshed Project?
 - a. Participants in the Seven Mile Creek Fuelshed Project exhibited transformative learning as a result of the workshops. Transformation was not uniform among all participants.
 - b. The design of the participatory process has implications for learning.
 - c. Common ground, common experience and common understanding were found to be expressions of a larger idea about the collaborative process.

The following is a discussion of the findings. When possible, supporting information for each finding is presented in the participants' own words. The descriptions and quotations used try to show the breadth and depth of viewpoints expressed.

Research Question One

What are the participants' experiences with collaborative processes? The multi-stakeholder process used in the Seven Mile Creek Fuelshed project was planned as an educative process. In other words, the research team planned for learning to occur and as a result expected participants to explore their own and others' perceptions about agriculture and the production of biomass in one of the most productive corn and soybean agricultural areas of Minnesota. The context of this research project is summarized by research team member RT6:

I think people learned something through the workshop activities, I'd say 'Yes.' The landscape tour was helpful for us all to better understand the landscape and current practices. The morning presentation about this project/AFEX left folks with more questions than answers but that is part of the learning process. The afternoon activity was helpful in understanding what additional pieces of information participants need at future meetings. I learned - as I think the entire research team did - that we could have better facilitated the afternoon session so it wasn't so focused on biomass/questions about biomass in the landscape, production of AFEX pellets.

The same team member stated,

I learned that using this technology / the idea of a new practice as the organizing principle for encouraging landscape practice change is more 'emotional' or controversial than I thought. I heard folks talk about the history of farming and that this type of suggestion (use of AFEX) is a monumental shift from current practices and there is resistance (sic) to change. When I was initially engaged in this project I understood it to be more about landscape change and encouraging best practices in farming relative to habitat and water quality. The focus on AFEX is not new to me at this point, but I had a similar reaction as the stakeholders did when I realized that is the focus of this project. As far as process - there is a lot still to do but I realized there are strong voices in the group and providing opportunities for all folks to contribute is going to be very important. We can modify some of the activities to encourage greater sharing / less dominating of discussion and we will do so.

Participants shared their experiences and shed light on key elements of the collaborative process. The first interview clearly showed that participants bring prior knowledge, expectations and pre-conceptions to the collaborative process. This prior knowledge and proclivity to be open to learning set the stage for the participants' engagement, learning and change. Findings focus on what is expected in a collaborative process and include the expectation of a clear objective, proclivity to be open to learning, and expectations of who should and who should not be included in the process. The

following section describes the participants' previous experiences with and general expectations for the collaborative process in more detail.

Finding 1a

Participants expected to have complete and credible information about the topic and objective. C2 believed collaborative processes must have a clear objective and clearly articulated process. C2 stated,

In order to be effective and useful, I think it's important that it [the collaborative process] be well organized and that there be a clear set of expected outcomes. And by expected outcomes I mean not a clear sense of what the outcome should be but a clear sense of what it is that is desired.

C2 reiterated this in the second interview,

For me it would have been useful if I had seen or heard a more clearly articulated stating of the objectives. . . . I found myself wondering from time to time at least early on in the process, wondering just which of these things [food production, water quality, habitat, biomass] is the primary purpose for which we're gathered.

V1 suggested that a collaborative process have clearly defined "mile markers" showing what will be achieved at each meeting. The mile markers would help keep people on the same page.

Related to wanting a clear direction for the process participants during their second interview and in the focus group expressed their belief that the University of Minnesota was a credible facilitator of the process. The credibility of the information

being presented and the process was why L1 and U1 participated. During the focus group L1 stated,

Part of my . . . wanting to continue to participate is the fact that this is driven by the University of Minnesota. So many times you know you always consider the source of the delivery and if the University of Minnesota thinks enough of this . . . to put the resources and people and great minds that they have assembled to do this into it . . . I'm there.

U1 noted that the relationship the organizing group has with the participants is:

A factor that makes a difference in terms of people's attitudes . . . and their willingness to learn from it [the process]. . . I think the University of Minnesota was a great face to come into the Seven Mile Creek process. . . . There's sort of a close connection between farmers and the University system and so it was a pretty non-threatening kind of thing.

Finding 1b

Participants expected to be able to learn about the AFEX process and make rational judgments about the production of biomass. The legitimacy of the judgments made was determined by the participants. Participants often sought a variety of viewpoints to inform their decision-making process. The exception is when a participant was representing external interests or organizations. Such an interest may have prohibited the participants' interest in making an independent decision. Many participants were aware of and concerned about how the selection of participants can shift the decision making process. Some participants desired more representation from certain groups and

asked why others were involved. Most by the end of the session said we had a good mix, or there should have been more farmers. Participants also stated the purposeful mixing of participants with different interests in the small groups was one of the things that contributed to the dialogue and legitimacy. U1 noted,

It's just something that sort of is a challenging puzzle to me in any kind of collaborative process . . . that is the mix of players that you're going to have and the challenges that brings . . . what methods we're going to use to get at some of those differences in the way that people think and whether or not they're willing to sort of think about trying something new or some new type of thinking.

For G2 a collaborative process involves gathering all of the interested stakeholders. G2 stated,

You can't create a solution for an entire community or an entire watershed or stakeholder group based on the opinions of a few. You really need representatives from all . . . even if one of those sides may be contrary to what you're trying to achieve.

Regarding collaborative processes and transformation of world views, X1 responded,

What I learned is that some students flee from it [The transformation of viewpoints]. I mean it's a scary transformation. . . It's really about entering into another culture. Back to the topic at hand [collaborative processes], it's probably an avenue for that [transformation] because you're in dialogue with someone and you feel like you're on equal footing

and having a say, it's less threatening. You have some agency. An ability to affect the outcome and it can be a less scary avenue into that transformation. . . . I think the collaborative experience can enable that transformation.

X1 then related what a lack of collaboration feels like, what X1 labeled, “the absence of the language of resistance.”

If you're not in collaboration and you're feeling like you're being manipulated and controlled or if participants are representing an interest and if participants are not quite yet ready to give into this participatory part that is the 'language of resistance.'

X1 went on to state,

You have to find a way to invite people to that place where they say, 'Well there's some advantage, if I go with the flow I can gain something, I can solve my own problems.' And that requires a listening process . . . the facilitators and people running the process need to be open and sensitive to finding those areas where it does become a win-win.

Finding 1c

Participants expected the opportunity to participate through dialogue and to listen and learn from others during the collaborative process. From notes taken during R1's interview, R1 summed up the result of dialogue with others: “*Hearing perspectives different from your own makes you temper your opinion a bit and see different ways of getting things done. All come out of the collaborative process with different (new)*

understandings.” U1 stated, “*Well by collaborative, I assume you mean a sort of diverse range of people or groups getting together.*” U1 went on to further explain two key elements of the SMCFP. First, the SMCFP includes the ability of the organizers to pick the participants for the process. Second, the Seven Mile Creek process is a non-linear interactive process as opposed to the linear processes often used to gather input on a planning project. U1 went on to describe different types of learners; those that are willing to challenge their thinking, and those that are less willing to do so.

The Seven Mile Creek . . . has done a good job then of coming out of a number of different ways in terms of whether . . . interests are specifically involved in environment or conservation or whether they’re about economics or whether they’re about farming or . . . water quality. . . . to let the conversation go inside that group [of people]. To me that’s on the right path.

A collaborative process involves a wide range of people. Z1 stated,

Part of the whole thing is learning who all the players [are] and why are they there. You know what is their particular interest . . . is it something they want to advocate for or is it something that they want to protect? You’ve got some that [say] ‘Well we better show up too to see whether or not we’re going to have to take any action on this.’

Regarding willingness to listen, W1 stated, “*The emphasis is on letting participants be heard.*” G2 stated,

I think listening is really an important skill and understanding that just having a better understanding of the fact that most people want to work together. I don't think a lot of people go into something wanting to disagree but a lot of folks are just defensive about their own opinions or mindsets and so a collaborative process really creates a respectful environment where you are required to listen to other viewpoints and maybe be opened up to how someone else is looking at the situation, so I think definitely listening and open mindedness [are required in a collaborative process].

There was one response that suggested participants must be open to being vulnerable.

M1, like other participants, describes the process as the need to be open to learning and the need to listen. Transparency and respect were also important to M1. The following is a paraphrasing of M1's statements,

Collaborative planning is a group of people trying to work out a problem and come to solutions. The process, ideally, is not prescriptive. An open attitude is valued and respected. The process itself involves learning. There is give and take over discussion in a collaborative process: a learning of new ways of seeing things. The collaborative process requires that participants have respect for each other so that all participants are willing to listen. Participants must be open to being vulnerable. A prerequisite for participation in a collaborative process includes being open to learning. The process itself needs to include clear discussion, the

ability of participants to state their opinions, and the ability for everyone to have their say. There needs to be transparency between the organizers of the process regarding objectives or goals. All participants need to be transparent about their goals.

As described by the participants in the second interview, the expectations for diversity, dialogue, openness to learning, a willingness to listen, and a willingness to be vulnerable were met by the Seven Mile Creek Fuelshed project. Overall C2 found the Seven Mile Creek Fuelshed Project “to be of value” because of the diversity of backgrounds of the participants and looking at the various aspects of food production, biomass, water quality and habitat improvement. C2 stated, “Overall it struck me that the concept and the process was useful and helpful for the participants. . . . Looking at those all important and somewhat separate areas of concern that people have was of significant value in approaching sets of issues.” In response to a question about particular pieces of the process that were important to learning G2 responded,

The opening discussions . . . the time that we had in groups to map out on the watershed, it really gave us the opportunity for people to express what was important to them and what their thoughts were and . . . it was structured, but the conversation was unstructured and being able to learn what everybody that was in that room cared about was very important and just recognizing that all those needs had to be represented.

Also, G2 indicated the presentations made by the team and others during the first few workshops were “critical” to answering foundational questions. G2 thought there was a

“good mix of . . . presentations at the beginning and the information that the [geo] design tools did convey.” G2 also noted the discussions were important to *“nailing down our objectives and some of the main goals.”* L1 found *“having experts on hand . . . as resource people, to answer questions and clarify and create understanding, was extremely beneficial.”* L1 commented on the purposeful selection of participants to work in small groups,

The more [inter] action of different peoples, the different interest groups, the different mix of people matched up was . . . good, I found that useful. It's easier for all of the Ag community to be on one table and all of the people that are environmentally professionally employed at another, you know, this way there was a mix and that was good. I felt that was something that was positive for the process.

L1 also commented that the participatory process made him

Feel at ease and comfortable with the facilitators and the facilitation and the surroundings. . . . I thought everybody did a really good job . . . I felt very at ease to give my opinion. I felt like I was a valuable partner in the process and that my opinions and observations were taken seriously and given some sincere consideration . . . I really thought it was very professionally done and done well and it made me feel very at ease and very comfortable coming to the meetings.

U1 commented on the importance of hearing a variety of opinions. *“It was helpful for me to hear some of the opinions of the other people . . . it was interesting to hear them more*

specifically articulated.” U1 stated, “*We could hear the viewpoints of the other participants in the process.*” Another element U1 commented on was the expert presentations and how the presentation stimulated “follow-up conversations.”

Finding 1d

Participants bring a predefined proclivity toward learning and the collaborative process and this openness to learning can have positive or negative effects. The proclivity toward learning is defined by participants in several ways including willingness to learn, listen and be vulnerable as already discussed above. Openness to learning was assessed by observation, review of the interview data and review with research team member RT6. Table 4, summarizes those observations and changes in different participants’ proclivity toward learning based on Yorks and Marsick’s (2000) description of how participants decide to engage in dialogue. They describe participants who engage in the process with tentative trust and openness, who adopt a position of constructive distancing, wanting to control their own experience, and who adopt a personal script that is politically acceptable to the group or their own community of practice (Yorks and Marsick, 2000).

Table 4

Participant Proclivity toward Learning

Participant	RT4 rating	RT6 rating	Observed change	Comments
C2	b	b	n/c	C2 is constructive with a strong focus on representing the farming interest. C2 is not easily swayed by others. C2 was very engaged in the geo-design process.
G2	a	b - a	b to a	G2's employer asked G2 to participate. G2 developed trust and interest in learning.
I2	a	b - a	b to a	I2 comes with an ecological perspective and is skeptical.
J1	a	b	n/c	J1 approaches things from a mediator perspective; J1's view is one of finding middle ground.
L1	a	c	n/c	L1 came in with an agenda. At the same time L1 is open to learning.
M1	a	a	n/c	M1 came in with openness and trust. M1 has a strong sense of what is fair in a collaborative process and will vocalize that privately when that sense is violated. M1 has continued to be open to learning. M1 is not afraid to do and learn new things.
N1	c	c	c to b	N1 has a strong personal script. After using the geo-design tool N1 became more engaged.
O1	a	a	n/c	RT6 did not have much to comment about O1. O1 is trusting and open to learning.
P1	a	c	c to b	P1 came in with a bias toward biomass production and has become open to other viewpoints
R1	b	b - a	b to a	R1 exhibited a shift to tentative trust. R1 was concerned about the University, as an outsider, coming into the county to push an agenda. R1 was energized by the geo-design process.
U1	a	?	n/c	U1 is both interested in the process, engages easily in discussion and wants to learn
V1	b	b	b to a	RT6 commented that V1 had a tendency toward a personal script. V1 likes come straight to the point. V1 is a deep thinker and wants to know about the assumptions being made. A shift toward trust and willingness to learn was observed.
X1	a	b - a	n/c	X1 has an ecological agenda.

Note. As observed by researchers RT4 and RT6. The ratings are based on the work of Yorks and Marsick (2000).

An observed change or shift in the proclivity toward tentative trust and openness is evidence of transformational learning.

KEY: a – tentative trust and openness; b – constructive distancing; c – personal script; n/c no change

Research Questions Two and Three

What are the participants' experiences regarding transformative learning?

What are the links between transformational learning and changes in participants' understanding of agriculture in the SMCFP? The findings for research questions two and three directly relate to transformative learning and to links between transformative learning and changes in the participants' understanding of agriculture in the Seven Mile Creek Fuelshed. The findings are helpful in understanding the characteristics of the collaborative process that foster transformative learning.

Finding 2a

Participants in the SMCFP exhibited transformative learning as a result of the workshops. Transformation was not uniform among all participants. Mezirow (1991b, 2000, 2009, 2012) describes four types of transformative change: people can: a) elaborate or expand upon existing frames of reference, b) append, supplement or add on to their existing meaning schemes, c) transform or create new meaning schemes and d) transform their meaning perspective. Participants exhibited one or more of these types of transformation. G2 described an expanded understanding of how landscape scale change in farming practice might occur, a transformation of frame of reference. G2 stated,

[Landscape scale change in farming practices are] a much more complex issue than I came in thinking it was . . . It's easy to fall prey to the idea that if you plug all the factors in just one sort of equation and consider what needs to be considered then an outcome can be reached, but it's a lot messier than that and I think one thing I learned as far as viewpoints

being changed is that change is going to take a lot longer than one might expect. I really don't think that biomass production is going to start happening on a large scale next season the way that . . . maybe I thought was feasible before the sessions . . . I also learned that many more people are open to the idea than I thought might be . . . as long as some of the things that are important to them are in place. . . . as long as the farmer has access to a market and is assured that they'll improve the quality of their farm and make enough money that, you know, this is really is a viable process.

G2 also described a process of compromise and learning that is descriptive of transforming meaning schemes. G2 felt the process used in the Seven Mile Creek Fuelshed project was

A very positive experience . . . being introduced to new viewpoints and I think it was, there was a really good intentionality there to bring people that were representing different sectors together and I think the groups that you all put us in were really thoughtful . . . and so I think the collaborative process was really an interesting way to find some middle ground, as opposed . . . [to] the way a lot of work normally is where you're just talking to people in your same circle and coming to similar conclusions. The way we had to compromise . . . whatever lessons we learned and conclusions we came to at the end were pretty indicative of a

middle ground because the groups were put together really well, so I enjoyed the collaborative process.

The process of learning and changes in meaning schemes is elucidated in the following interview excerpts. In the first interview, J1 expressed excitement about learning, stating,

I'm looking at this as almost a continuing education class . . . because I think it is great to like I said gather this information, gather facts about AFEX and more facts about the watershed and . . . feed stocks.

J1 had an interest in becoming aware of new facts and options about the topic at hand. Change for J1 was a result of talking with individuals with diverse ideas. During the second interview J1 stated, *"I think the tour [ravine management] was probably the most valuable piece, then obviously second would be the tool [geo-design] and then maybe third would be the speakers."* J1 also suggested, *"If I changed my perspective on anything [it was] by talking to individuals."*

While change in meaning schemes occurred for many participants, transformation in meaning perspective (habits of mind) was clear for only one participant, M1. For M1 the dialogue process was an essential linkage between learning and her changes in how she viewed agriculture. M1 stated,

I think what got easier as things went on was my participation and discussions that we had in small groups and maybe raising my hand a time or two in the larger group discussion. I just began to feel more at ease with the group and I'm just by nature an introvert so it takes me a little while to get my bearings in a group.

M1 experienced transformation of her meaning perspectives about farming. M1 stated,

I've never actually taken a tour of a watershed before and thought that was pretty interesting the way that we looked at the mouth of the Seven Mile Creek and then sort of wandered around and up to the top of the watershed. It was well organized and well presented. I saw some things I hadn't seen before.

M1 recalled what she learned from the workshops:

[I] learned that there are a lot of people, very dedicated, very intelligent people working on various aspects of the interaction of business and the environment and agriculture. I came to respect a lot of people who work in those fields.

M1 compared her experience to her existing knowledge about the medical field as,

I think I probably felt something like a non-medical person might feel in an advanced discussion of cardiac failure or something. You know you glean little bits of information and have little ah-ha moments of 'oh okay' I see how that works or doesn't work. I learned a lot about agriculture; about problems with soil and fertilizer.

M1's viewpoint of Seven Mile Creek was significantly and permanently changed. M1 described the credibility of the U of M and the process of dialog as being responsible for that change. M1 stated,

My first reaction . . . was, what on earth, what about; you know what is this process? This plant that they're talking about putting in the Seven

Mile Creek, and to me Seven Mile Creek is Seven Mile Creek Park and what are they doing to our park? . . . I had some negative vibes going into it. During the process of learning what it was it seemed the concern of the participants and also thoroughness of which the U of M went about studying the whole watershed and the whole idea of the AFEX plant kind of made me sit up and say 'Oh, okay there, there are possibilities here, this isn't some weird, off the cuff project, this has been very well studied.' . . . I had respect of the staff of U of M doing it and for the participants who were in it . . . so I changed from a negative look to a, 'Oh okay let's look and see a little more about this.' . . . Looking at how it all intersects and the different things you have to consider was just incredibly complex, and I think 'Oh, okay this one, whatever it is,' one idea sounds really good and then someone else in the group would counter with another thought and I'd go, 'Oh all right let's rethink that.' There's just so many things to consider from the water quality policies to landowners participation.

M1 is self-directed, reflected on her experience and re-integrated what she learned back into her life. As a result of the Seven Mile Creek Fuelshed Project and her involvement with the League of Women Voters, M1 attended a soil management workshop. *"I was impressed with all of these farmers who were interested in doing soil management better."* For M1 attending the soil management workshop was, *"Another aspect of what we had been talking about at our fuelshed discussions and I just wanted to get a little better understanding of some things."* M1 continued, *"I guess you know when something*

piques my interest . . . one thing leads to another and it's a learning process that never stops. M1 also signed up for a ravine workshop. M1 states,

It's an interest that I now have. Until this time agriculture was something that other people do and I go to the farmers market and I buy breakfast cereals and don't think too much about other things having to do with agriculture and the balance that needs to be made between the ag industry and environment. It has broadened my knowledge of the topics, so for me that's been good and it's been good, I think, for the discussions that we are going to be having in our local [League of Women's Voters] league.

Finding 2b

The design of the participatory process has implications for learning. The SMCFP included several elements including dialogue, the use of a geo-design tool, and small group discussion. These elements are reflected in the response to interview questions. As already discussed, G2 believed the opening discussions and time spent in the watershed “Really gave us the opportunity for people to express what was important to them.” G2 also indicated the presentations made by the team and others during the first few workshops were “critical” to answering foundational questions. Regarding the geo-design tool G2 stated “We could probably have gotten a little bit more out of those, but there were so many technical difficulties . . . [the geo-design tool] actually forced us to talk more than design which helped us move forward.” G2 thinks there was a “good mix of . . . presentations at the beginning . . . information that the design tools did convey”, and

interaction with other participants. G2 also noted the discussions were important to
“nailing down . . . objectives and . . . some of the main goals.”

For M1 and others, dialogue was an important part of the learning process. M1 stated,

I like listening to the other people in my small groups. . . . I would get different perceptions from the different people depending on what group I happened to be sitting in or who I happened to be sitting next to . . . at lunch time when you just sort of sit down somewhere the lunchtime informal discussion were pretty interesting too. . . . Through listening [you] can learn an awful lot, so that's kind of what I do, I listen and try to learn.

J1 provided several examples about the process that worked and did not work. For example,

I personally felt a person of value, that my opinion and experience was valuable to the group and to the organizers and I appreciated that . . . I thought it was very interesting to, to see the different individuals from different backgrounds and different experiences and expertise and hats that everyone wore . . . I felt that how you pulled together, the leadership of this Seven Mile Creek group pulled together, a lot of important people that were willing to share their thoughts and experiences and opinions.

In regard to a question about having the right folks in the room, J1 thought more farmers, bankers and city people would have been interesting. J1 stated, *“I think overall your team*

did a good job on selecting those individuals and you had the right, I think, mix of the environmentalists and I thought it was very interesting. I enjoyed it.”

Regarding the geo-design tools, J1 felt the touch screens were “*Very, very outstanding, I thought, even though we had some quirks at different meetings, I think we’re on the right track, or you’re on the right track.*”

U1 noted several elements of the Seven Mile Creek Fuelshed Project process that were important. For example, U1 stated “*It was helpful to hear some of the opinions of the other people. . . . It was interesting to hear them more specifically articulated.*” U1 continued, “*We could hear the viewpoints of the other participants in the process.*”

Another element U1 commented on was the expert presentations and how the presentation stimulated “*follow-up conversations.*” U1 also liked the geo-design tool. “*People were able to gather around and say okay where might this occur, where might that occur? To me that fosters a sense of group learning.*”

The multi-stakeholder participatory process used in the Seven Mile Creek Fuelshed project was focused on dialogue and utilized a geo-design tool to foster deliberation. The process did not explicitly foster individual self-reflection. Yet self-reflection was articulated by C2. C2 stated,

It was of value to me to be able to look at the, for lack of a better term I’ll say linkages between those separate areas of concern [food production, biomass, water quality and habitat] and linkages is not quite the right word because . . . what turns out to be of a higher value for one purpose is not necessarily valuable for another person. For example, some of the

things that were discussed as opportunities for control of run off perhaps would have very little contribution because of their configuration for wildlife habitat. . . . The significance of all of that is that it generated in I think the minds of most of us it generated . . . perspective on the values and importance in each of these areas.

Finding 2c

Common ground, common experience and common understanding may be expressions of a larger idea about the collaborative process. Participants described collaborative processes and the Seven Mile Creek Fuelshed project in particular as a means to finding common ground, common experience, and common understanding. In the first interview, A1 commented on collaborative processes in general,

As a group they've got to come together to find an answer. What does the group value the most? What does the group find that is the most important to them and it is going to be a little different for everyone, but this term is used a lot, but there are some common elements everyone agrees upon and that's what politicians term as the common ground.

E2 noted that collaborative processes have the potential to change participant beliefs and attitudes, while recognizing that every participant comes with a different understanding:

Maybe in our situation all of us agree it would be great to clean up Seven Mile Creek but a lot of us have different, either production interests or environmental interests, or economic interests. . . . We'd all meet [at]

some point of an understanding and agreement on how we're going to proceed with the Seven Mile Creek project, mostly because we've gone through an experience together not just that we're all coming with our different backgrounds and talking with each other and deciding what we're going to do. We've had an experience together, a very thorough experience that digs kind of deep into our minds and we all leave there kind of, kind of together. Maybe not an understanding but an experience, that's probably why it's so effective for work like this.

E2 continued:

I would anticipate that there being some agreement or consensus within the group, not because we all compromised on whatever indecisions we have an opportunity to make but because we have all learned about the process together. You know we didn't learn it from an environmental standpoint and we didn't learn it from an economic standpoint and learn it from a production standpoint. We learned the project together and we experience together and a lot of the questions that you're taking us through to help us learn more about the project are at a fairly deep level. They're really challenging for most of the participants and that's why I think in the end we all will come to some type of understanding with the way the project will or will not proceed.

P1 noted that a collaborative project is a project that involves two or more people for the purpose of achieving a predefined goal. The role of learning in the collaborative process

is important. The ability for all to think and reflect on the meeting, to present ideas and to build on those ideas is the essence of collaboration. This process builds relationship and bridges that serve to facilitate success in future projects. A barrier to collaboration occurs when participants are not ready to share ideas. The non-verbal communication process is important and provides a richer experience. P1 hopes to learn and understand new things that will make the Seven Mile Creek Fuelshed Project more effective. In the first interview, P1 described dialogue in terms of a process of thinking about ideas and collaboration. P1 stated,

It's sort of like you have all the answers but you don't really have all the answers. You just have thought about it and have ideas that you're presenting that you want other people to think about and contribute to and make it better ideas, you know so then what I learned to do is I thought about these things, but when I brought them to the discussion I would bring them in what I would call a more elementary form. So they aren't thought out ideas, they're beginning thoughts.

P1 continued,

Well the thing that happens then is as you begin to discuss these things, new, other ideas besides my own are interjected and then for me then I just try to build off those. You know you have this sort of thread of an idea and then people add to it and that makes it better.

Paraphrasing P1 regarding ideal conditions for collaborative processes,

A pre-requisite for collaboration is for participants to come prepared to share ideas. When this doesn't occur it is important to back off and let everyone build ideas together, injecting ideas as the discussion matures. Collaboration is also about building relationship even when it means building bridges with those that have different agendas.

This relationship building for P1 is important to the success of the project at hand as well as future projects that might involve some of the same participants.

Summary

Seven findings have been presented. The first four relate to research question one and focus on the participant experience and expectations for a collaborative process. The four findings were, a) participants expect to have complete and credible information about the topic and objective; b) participants expect to be able to learn about the AFEX process and make rational judgments about the production of biomass; c) participants expect the opportunity to participate through dialogue and to listen and learn from others in during the collaborative process; and d) participants bring a predefined proclivity toward learning and the collaborative process. These findings demonstrate an expectation by participants to learn through the presentation of science-based knowledge, an expectation for their own knowledge to be accepted, and an expectation to co-create knowledge with the facilitators and other participants. The data also show there are limits to learning imposed by a participant's proclivity to learning. The final three findings relate to Mezirow's transformative learning theory and elaboration of frames of reference, the

creation of new meaning schemes, the transformation of meaning schemes or the transformation of meaning perspectives. Transformation of and changes in meaning schemes were common, while transformation of meaning perspectives was clear from the comments of only one participant. Regarding the collaborative process itself, collaborative processes have been assumed to create common ground and common understanding. The results of this study corroborate this and in addition show a link between common ground and common understanding to the concept of solidarity. Finally, as will be discussed in the next chapter, how the collaborative process is designed has implications for learning, especially transformative learning.

Chapter 5 -- Discussion

Using a case study approach, this research explored the characteristics of the SMCFP process that fostered transformative learning. This research is based on the participant's perspective and uses Mezirow's (1991b) transformative learning theory as a lens.

Rodela (2013), after reviewing 97 research papers on social learning, suggests using existing theories of learning to understand how social learning changes perspectives and leads to desired outcomes. Literature on collaborative process often reference Habermas' communicative action theory (Rodela, 2013). Transformative learning theory builds on Habermas' communicative action theory to explain individual learning (Mezirow, 1991b). Few studies have been conducted that use Mezirow's transformative learning theory as a lens. Lankester's (2013) case study of the beef industry in north-eastern Australia is one such study. Her theoretical lens included Kolb, Boyatzis and Mainemelis' (1984) experiential learning theory and Mezirow's (1991b) transformative learning theory. Similar to this study, her aim was to increase understanding of learning in a collaborative setting.

This study also addresses gaps in the educational literature on transformational learning. E. W. Taylor, a researcher studying transformative learning at Penn State, stated that longitudinal studies using transformative learning theory as a lens are uncommon. He suggested exploring the relationship between collaborative processes and transformative learning (personal communication, December, 2012). This study adds to the growing body of literature that describes the characteristics of the learning environment that foster

transformative learning by providing a description of what participants experienced and by providing evidence of change in participant perceptions.

Summary of Methods

During a nearly yearlong multi-stakeholder participatory and collaborative process that included eight half-day workshops, qualitative data was collected via interviews, focus groups and observation. Between the first and third workshops and after the final workshop interviews of selected participants occurred; after the final workshop a focus group was held. Observation notes were taken and the team's research journals were reviewed. Participants included 38 persons interested in exploring the potential for biomass production to enhance economic opportunity, improve water quality, and increase wildlife habitat in St Peter, Minnesota. The data were analyzed using Gilligan, Spencer, Weinberg and Birch's (2003) listening method. Each interview summary was organized by research question and emergent themes were grouped based on the theoretical framework provided by Mezirow's transformative learning theory.

The following three research questions were answered using the data collected.

1. What are the participants' experiences with collaborative processes?
2. What are the participants' experiences regarding transformative learning?
3. What are the links between transformational learning and changes in participants' understanding of agriculture in the Seven Mile Creek Fuelshed Project?

Discussion Framework

The framework used to organize the discussion is based on Maarleveld and Dabgbegnon's (1999) and Lankester's (2013) who, how, why and what questions. The individual provides the focus for who learns. Transformative learning theory is used as a lens to understand how participants learn. The characteristics of the learning environment that foster transformative learning are examined to explain why participants learn. What participants learn has been modified from Maarleveld and Dabgbegnon (1999) to examine the consequences of learning in a collaborative process. This framework is presented in Table 5. Future research limitations of this study and implications for Extension education are provided following this framework.

Who Learns

The participants in the (SMCFP) governed their own process of communicative action, self-expressing expectations or criteria for rational dialogue very similar to those described by Mezirow (1991b, 2000). It was found participants:

- Expected to have complete and credible information about the topic and objective at hand, including a clear objective and direction for the process.
- Expected to be able to learn about the AFEX process and make rational judgments about the production of biomass.
- Expected the opportunity to listen and be heard by others.

Table 5

The Who, How, Why and What Framework

Framework	Conclusion	Finding
Who learns?	The participants in the (SMCFP) governed their own process of communicative action, self-expressing expectations or criteria for rational dialogue very similar to those described by Mezirow (1991b, 2000).	<ul style="list-style-type: none"> Participants expect complete and credible information about the topic at hand and the objectives of the process. Finding 1a Participants expect to learn about AFEX and make rational judgments about the production of biomass. The legitimacy of the judgments made is determined by the participants. Finding 1b Participants expect the opportunity to participate through dialogue, to listen and learn from others. Finding 1c
Why did participants learn?	The characteristics of the SMCFP that fostered transformative learning include a project focus, prior experience, expert knowledge, dialogue, deliberation and reflection.	<ul style="list-style-type: none"> The design of the process has implications for learning. Finding 2b
	Individual and group learning can be influenced positively and negatively by the participants' proclivity toward learning.	<ul style="list-style-type: none"> Participants bring a predefined proclivity toward learning and the collaborative process. Finding 1d
How did participants learn?	Transformative learning is an important part of learning in a collaborative process. .	<ul style="list-style-type: none"> Participants exhibited transformative learning. Transformation was not uniform. Finding 2a
What are the consequences of learning?	Solidarity is an appropriate description of the outcomes expressed by participants regarding common understanding, common ground and common experience.	<ul style="list-style-type: none"> Common ground and common understanding are expressions of a larger idea about informal collaborative processes. Finding 2c

The above findings very closely match many of the criteria Mezirow (1991b) posits as conditions for rational discourse. The SMCFP research team was able to create conditions for participation which enabled participants to set aside their preconceptions and seek to understand each other despite differences in background, experience and values. Quoting from Mezirow (1991b), these criteria include:

- Have accurate and complete information,
- Be free from coercion and distorting self-deception,
- Be able to weigh the evidence and assess arguments objectively,
- Be open to alternative perspectives, . . .
- Have equal opportunity to participate (including the chance to challenge, question, refute, and reflect and to hear others do the same) (pp. 77-78).

Legitimacy was one result of participants being able to make their own judgments about the AFEX process. Mezirow (1991b) suggests without legitimacy, communicative action can be manipulated and the consensual meanings that otherwise might have developed can be lost. According to Kemmis and McTaggart (2005) the action of communication has the purpose of reaching “*intersubjective agreement* as a basis for *mutual understanding* so as to reach an *unforced consensus about what to do* in the particular practical situation in which they find themselves” (p. 576). Allowing space for participants to own the process was the basis for legitimacy. The idea that legitimacy is defined and created by the participants may be of some interest to Extension educators and to facilitators of collaborative processes.

Why Did Participants Learn

What conditions fostered transformative learning? The design of the collaborative process has implications for fostering transformative learning. From the data and an examination of the process, six elements fostered transformative learning and a change in how participants viewed farming: three process elements dialogue, deliberation and reflection; and three contextual elements a project focus, participant prior experience, and expert knowledge.

At each of the eight workshops held as a part of the SMCFP time and space for dialogue and deliberation was included. Dialogue differs from deliberation in the following way. Dialogue is a communicative learning process, while deliberation is based on a cause and effect relationship and focuses on instrumental learning processes (Brookfield & Preskill, 1999; Daniels & Walker 2001). Both dialogue and deliberation offer venues for vetting individual participants' ideas, beliefs, values and perceptions (see Figure 3).

A project focus, participants' prior experience, research based knowledge, dialogue, deliberation and reflection helped create conditions that fostered transformative learning. Together these six elements operated to set the stage for elaborating existing frames of reference, creating new meaning schemes, transforming existing meaning schemes and transforming of meaning perspectives. The following sub-sections describe, through the lens of Mezirow's transformative learning theory, how these six elements may have fostered transformative learning.

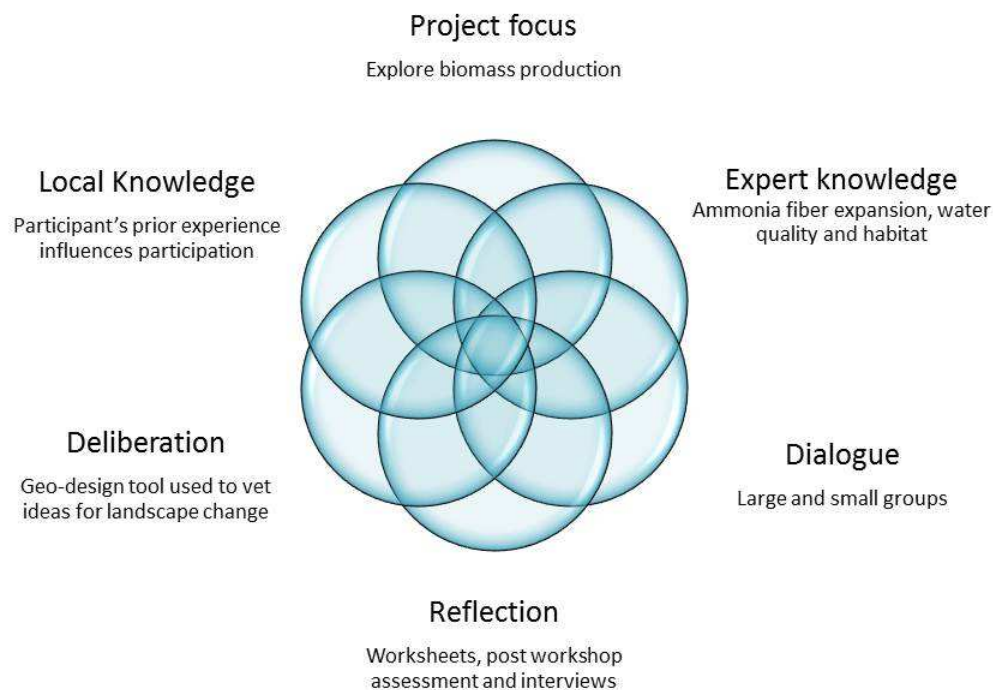


Figure 3. Six elements fostering transformative learning.

The Project Focus

The SMCFP purpose was to engage selected participants in the exploration of the production of biomass and the exploration of the resulting impacts on farm economics, water quality and wildlife habitat. Participants expected complete and credible information about the biomass production, the AFEX process and the objectives of the SMCFP. In addition to a clear purpose, the participants expected a “road map” of the process. (See Chapter 4, finding 1a.) This may have been so the participants could act on what they expected to learn. Freire (1970/2000) underscores the importance of a concrete

situation upon which the participants might act and expands this to include the need for the focus of the action to reflect the ideas of the participants. A clear project focus provided an awareness of the need to act (Mezirow, 1993).

Reed, et al. (2010) describes social learning as learning that is relevant to the participant and to the participant's community of practice. The research team expected that the participants would find the workshop enjoyable and beneficial. Also, it was expected that the participants would gain a deeper understanding of multi-functional agriculture as a foundation for future action.

The SMCFP engaged participants around an opportunity, while many social learning processes are focused on solving problems. Because of the credibility the University of Minnesota brings, it was uniquely positioned to introduce the AFEX process and create a space for engaging participants in dialogue and deliberation about farming and the agricultural landscape. One participant commented during the focus group:

Part of my wanting to continue to participate is the fact that this is driven by the University of Minnesota. . . . You always consider the source of the delivery and if the University of Minnesota thinks enough of this . . . to put the resources and people and great minds that they have assembled to do this . . . I'm there.

The Role of Prior Experience

People come into a collaborative process with prior experience. This prior experience influences what the participant will pay attention to and how they learn, (Bransford, Brown & Cocking, 2000). (See Chapter 4, finding 1b and 1c). Individual and group learning can be influenced positively and negatively by the participants' prior experience and proclivity toward learning. Yorks and Marsick (2000) describe a potential limitation imposed by participant predispositions to learning. These authors suggest some participants react with tentative trust and openness, some with constructive distancing, and others with a personal script. Those with tentative trust are ready to interact with others, those who engage in constructive distancing need to overcome internal barriers to interaction and those with a personal script may be representing an external organization, thus limiting their own personal learning. Finding 1d, described in Chapter 4, suggests participants in the SMCFP did have predefined proclivities toward learning. Participants who approached group learning with tentative openness and trust were the most open to transformation and communicative action while those who approached it with a personal script were the least open to learning. How the proclivity of one participant toward a personal script limited freedom of dialogue is described by research team member, RT1:

I also noticed that the groups seemed able to begin design work, as guided by us, without much preliminary discussion, . . . although one group was a marked exception. In the latter group, a highly vocal person raised questions and shared observation, both of which had strongly tangential links to the design challenge that we had posed to them.

It was the consensus of the research team members to re-organize small groups at future workshops to minimize the risk of one participant pulling other group members away from the group activity. By recognizing the participant's approach to learning and adjusting accordingly educators and practitioners can adjust the collaborative process to fostering transformative learning.

The Role of Expert Knowledge

Expert knowledge about the AFEX process, the production of non-woody biomass, water quality and habitat served as a catalyst for discussion. AFEX, however, was what piqued the interest of participants and brought them to the table.

The Role of Dialogue

The SMCFP created time and space for participants with diverse backgrounds and opinions to engage in learning about AFEX through dialogue. This type of learning is referred to as communicative learning. Gustavsen (2007) describes the dialogic process as one that is "a free and open conversation between equal partners for the purpose of reaching agreement" (p. 97). Gustavsen describes several benefits of dialogue including providing the opportunity for a broad range of participants to be heard and build agreement. Dialogue also builds capacity for participants to express and defend their viewpoints (Gustavsen, 2007). Not all views of dialogue have the purpose of reaching agreement. For example, Bohm (2003b) suggests dialogue's purpose is to seek understanding.

Building capacity for participants to express their viewpoints through dialogue represents a shift in power from the educator, researcher, or facilitator to the participant.

This is similar to how fostering transformational learning represents a shift in power from the educator to the participant (Kegan, 2000). As a result of empowerment, the participant is free to be self-determined. Participants engaging in a collaborative process want a clearly outlined focus, however they want to be free to think and learn based on their own aspirations. (See Chapter 4, finding 1b).

The Role of Deliberation

The researchers introduced a deliberative geo-design process into the SMCFP. The use of a geo-design tool allowed participants to create various landscape designs and receive real-time feedback on farm economics, water quality, biomass production and wildlife habitat. (See Chapter 4, finding 2b).

Deliberation has been considered an important part of collaborative learning by Daniels and Walker (2001), yet it is not a term that has been used in reference to transformative learning. The use of deliberation in the SMCFP is unique and extends the understanding of transformative learning as discussed in the next section.

Brookfield and Preskill (1999) define deliberation as a process where “different points of view are presented and supported by evidence, data, and logic” (p. 13). This is the domain of instrumental learning. Mezirow (1991b) states, “The domain of instrumental learning centrally involves determining cause-effect relationships and learning through task oriented problem solving” (p. 73). Daniels and Walker (2001) state, “Whereas dialogue emphasizes learning and understanding, deliberation builds upon that learning and understanding as parties begin to debate possible actions” (p. 133).

The Role of Reflection

Reflection is defined by Dewey (1910) as “Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends . . .” (p. 6). When a participant experiences a disorienting dilemma or hears something that does not fit with previously learned knowledge, the reflective process allows the participant to come to grips with this disorientation. Individual reflection can reduce the dissonance created from immersion into a dialogic process. Individual reflection can correct inaccurate assumptions in existing knowledge (content), in how to think about a problem (process) and in how an individual perceives the world (premise). Individual reflection, especially on premise can lead to transformation of meaning perspectives. Mezirow, (1991b) states:

The transformation of *meaning schemes* (specific beliefs, attitudes, and emotional reactions) through reflection is an everyday occurrence, it does not necessarily involve self-reflection. We often merely correct our interpretations. On the other hand, the transformation of a *meaning perspective*, which occurs less frequently, is more likely to involve our sense of self and always involves critical reflection upon the distorted premises sustaining our structure of expectation. Perspective transformation is the process of becoming critically aware of how and why our assumptions have come to constrain the way we perceive, understand, and feel about our world; changing these structures of habitual expectation to make possible a more inclusive, discriminating, and integrative

perspective; and, finally, making choices or otherwise acting upon these new understandings. (p. 167)

Figure 4 provides a visual representation of the four types of transformation in relation to reflection. Reflection in combination with dialogue or deliberation serves as a means for participants to make meaning and vet what they think with others. Mezirow (1991b) suggests changes in meaning schemes do not require self-reflection, however for changes in meaning perspectives to occur intentional reflection on premise is needed.

For researchers designing collaborative processes, creating time and space for reflection is as important as dialogue and deliberation. (See Appendix B, the logic model for workshop 6: outcomes where this is noted). Personal transformation can be fostered in Extension educational settings and in collaborative processes by fostering reflection. Utilizing the Seven Mile Creek Watershed as an example, Table 6 shows when reflection was most likely and presents questions that might be used to foster individual reflection.

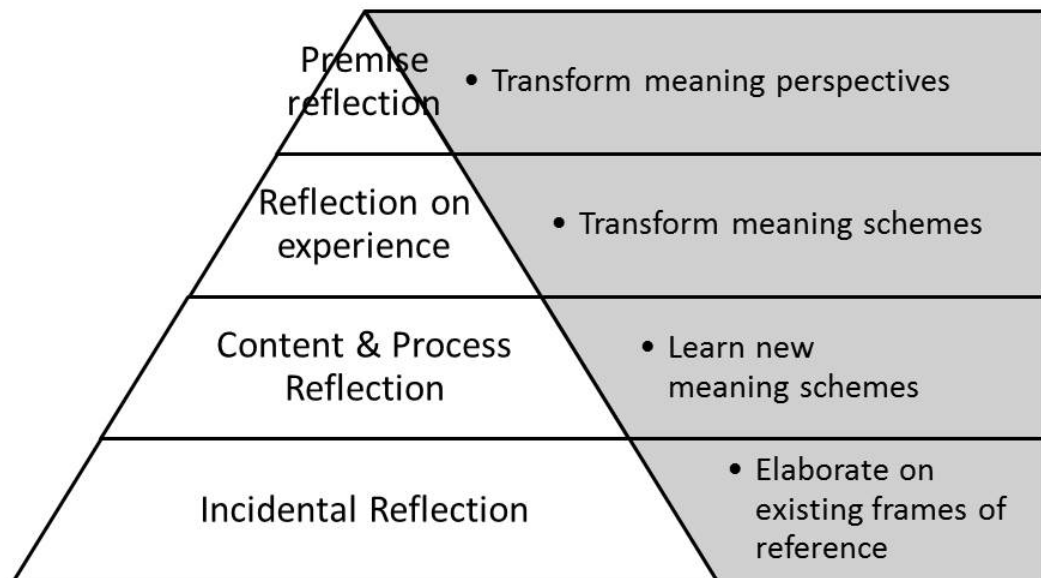


Figure 4. Reflection and the transformation of meaning structures. Adapted from Yorks and Marsick (2000) and based on Mezirow (1991b, 1993, 2000, 2009, 2012).

How Did Participants Learn?

In Chapter 4, evidence that participants exhibited transformative learning is provided (see Chapter 4, finding 2a). According to Mezirow (2000, 2009, 2012), transformations can occur in one of four ways

- elaboration of existing frames of reference,
- creation of new meaning schemes,
- transformation of existing meaning schemes and
- transformation of meaning perspectives.

It was found that transformative learning among participants was not uniform. More evidence was found for the elaboration of existing frames of reference and the creation of meaning schemes than for the transformation of meaning perspectives.

Table 6

Reflection on Content, Process and Premise

	Instrumental learning	Communicative learning	Emancipatory learning	Group learning
Content	What are the facts about the AFEX process and agriculture? <i>Information was presented as part of the process. Participants were asked if they had additional questions regarding the facts.</i>	What do others have to say about AFEX and changes in land use? <i>This question was implicit in the dialogue process.</i>	What are my assumptions? <i>This is a question some participants may have asked themselves.</i>	What are our assumptions? What are the rules of thumb used to design the landscape? <i>This question was explicitly asked during the geo-design workshops.</i>
Process	How do I know the facts to be true? <i>Participants in the focus group commented on the credibility of the University.</i>	How do I integrate others' points of view about changes in land use into my own views? <i>This question was implicit in the dialogue process.</i>	How do I know my assumptions are valid? <i>This question was included as a part of group dialogue and deliberation.</i>	How do we know the rules of thumb are valid? <i>This question was explicitly asked during the geo-design process.</i>
Premise	Why is this important to me? Why do I keep coming back? <i>What makes the process and content salient?</i>	Why should I adopt the AFEX process? Why should I be open to changes in land use? <i>This was reflected as common ground or common understanding.</i>	Why should I revise my perspective? Did my perspective change?	Why should we as a group change our practice? What are the next steps for us as a group? Did expectations change?

Note. The questions in each cell may be used to foster reflection on content, process and premise. This work builds on the framework developed by Cranton (2006) adding questions for group learning. The text in italics shows my observations of how space for reflection was provided in the SMCFP.

Figure 5, shows the types of transformative learning participants engaged in during the SMCFP. Wiggins and McTighe's (2006) facets of understanding were used to assess the participants learning. The facets of understanding are explanation, interpretation, application, empathy, perspective and self-understanding. Participants

exhibiting these facets were identified based on the closed and open coding approach used to analyze the data (see Appendix O and P). Lankester (2012) also provides evidence of transformational learning in her study of learning and sustainable agriculture in NE Australia. This study extends her work by providing more detail about the types of transformation and how to assess transformative learning. Evidence of the types of transformations participants experience has not been reported in the social learning literature. Finally, while not a new approach to assessing transformative learning, the use of Wiggins and McTighe's (2006) facets of understanding to assess participant learning provides an exciting approach to understanding the conditions that foster transformative learning in a collaborative process. Glisczinski (2007) in a previous study utilized the facets of understanding to assess critical reflection and perspective transformation.

The SMCFP provided a catalyst for change that, in Mezirow's terms, would be a disorienting dilemma. Disorienting dilemmas do not need to be unpleasant. The research team designed the process to be of interest and fun. The participants likely experienced inconsistencies between their existing knowledge and the knowledge they were creating together as they explored AFEX and changes in crop production. The SMCFP fostered conditions for transformative learning. Mezirow (1993) states, "Because communicative learning involves dealing with the ideas of others, it frequently requires us to confront the unknown. When we confront the unknown . . . our reflection may result in the creation of

new meaning schemes" (p. 82). The role of communicative learning and in particular the process of dialogue provides a forum for understanding others viewpoints.

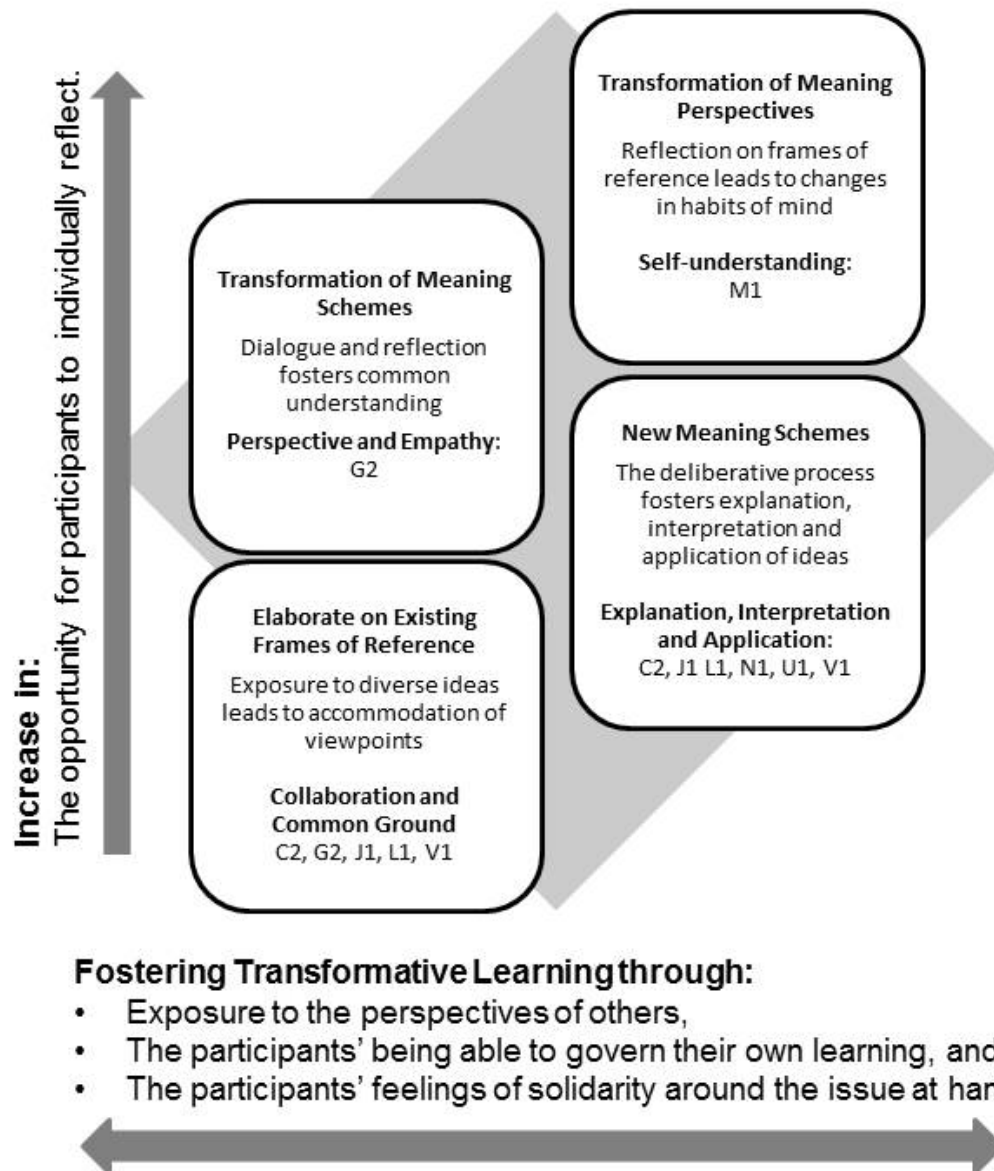


Figure 5. Evidence of transformational learning. Each quadrant is based on Mezirow's types of transformational learning (1991b, 2000, 2009, 2012). Participant's exhibited transformations based on evidence of learning assessed through Wiggins and McTighe's (2006) facets of understanding.

Elaborating Existing Frames of Reference

Participants in the SMCFP talked about the importance of dialogue and how it led to a softening of their own positions and an accommodation of others' viewpoints. From the participants' interactions with other participants, exposure to new ideas and diverse viewpoints, frames of reference were elaborated upon in an accommodative process. As participant J1 commented, *"If I changed my mind on anything [it was] by talking to individuals."* Participants who exhibited elaboration on frames of reference are listed in Appendix O: emergent theme, diversity; interview two.

Creation of New Meaning Schemes

As the participants attended subsequent workshops new meaning schemes were added. Meaning schemes are values, beliefs, and attitudes toward the topic at hand. The research team encouraged participants to develop rules of thumb as a means to guide the design process. Use of the rules of thumb required participant reflection on the content and design process. The rules of thumb set the stage for the creation of new meaning schemes as participants engaged in deliberation using the geo-design tool. It was also clear from the participant statements that the geo-design tool was the catalyst for the creation of new meaning schemes. U1 commented, *"People were able to gather around and say okay where might this occur, where might that occur? To me that fosters a sense of group learning."* Participants who exhibited creation of new meaning schemes are listed in Appendix P: emergent theme, instrumental learning; interview two.

Transformation of Meaning Schemes

Transformation of meaning schemes was less common than either elaboration of existing frames of reference or the creation of new meaning schemes. It may be that the SMCFP did not provide participants with enough time and space for reflection on their own experience; however, there are other explanations. Transformation is also dependent on time. Transformations can occur spontaneously, gradually, or after months or years after a participant experiencing a disorienting dilemma (Mezirow, 1991b). Also, participants experiencing the same setting do not experience the same type of transformative learning. For example, one participant may find the topic at hand outside of their normal experience and quickly elaborate on their frames of reference, create new meaning schemes, transform their meaning schemes, or transform their perspectives. Another person exposed to the same disorienting dilemma may experience very little change. Finally, the open-ended questions used in the interview may not have elicited comments describing transformation of meaning schemes. One participant exhibited transformation of meaning schemes (see Appendix P: emergent theme, communicative learning; interview two).

Transformation of Meaning Perspectives

Lankester (2012) found collaborative processes that support long-term relationships aid in communicative learning and foster reflection on premise. It is the reflection on premise and transformative changes in meaning perspectives that may have the greatest difference in peoples' lives. M1's experience of the SMCFP transformed her ontological and epistemic understanding of farming. By helping to make

recommendations on national agricultural policy with a nationwide non-governmental organization, M1 reintegrated her new understanding of agricultural practice into her work. M1 reflected deeply on her epistemic understanding of agriculture in the light of new knowledge, interaction with others, deliberation and dialogue (see Appendix P: emergent theme, premise reflection; interview two)

What are the Consequences of Transformative Learning?

Common ground and common understanding were expressed by participants in the SMCFP as a consequence of the informal collaborative learning experience. (See Chapter 4, finding 2c). Solidarity may be an apt description of the outcomes expressed by participants regarding common understanding, common ground and common experience. Kemmis and McTaggart (2005) suggest when two or more people create space for communication they build solidarity. These authors state,

First, it [communicative action] builds *solidarity* between the people who open their understandings to one another Second, it underwrites the understandings and decisions that people reach with *legitimacy*. . . .

Habermas' argument is that *legitimacy is guaranteed only through communicative action*, that is, when people are free to choose ... (Kemmis & McTaggart, 2005, pp. 576-577)

Solidarity is the essence of emotion, values, attitudes, beliefs, and intentions regarding the act of communication (Kemmis & McTaggart, 2005). Solidarity is built as a result of agreeing to enter into dialogue to understand, rather than argue a point. It can be the result of common experience, of individuals finding common ground or common

understanding. Yet solidarity does not require common experience, common ground or of building common understanding.

As an example of solidarity, N1 and M1 continued to view the agricultural system differently, yet both were in agreement to move forward with the next phase. N1 came in with a script, being focused on protecting existing farming interests. N1 also stated his opposition to having non-farmers as stakeholders in the process. At the beginning of the process N1 saw no place for AFEX in the Seven Mile Creek Fuelshed. M1, toward the beginning of the process, was also opposed to AFEX for different reasons, including a fear of change. Toward the end of the SMCFP N1, while still wanting farmers to be involved, saw that the AFEX process may have merit and might benefit farmers, while M1 learned what AFEX process was and accepted it as a possibility. I would not say these participants had common perceptions; rather, their past experience and the learning that occurred during the SMCFP allowed them to stand together to move forward.

Future Research

The data provide insight into needs for future research regarding what conditions in a collaborative process foster transformative learning. Two areas for additional exploration are described. The first relates to using different elements or combinations of elements to foster learning and the second to providing additional time and space for purposeful reflection on content, process and premise.

While six elements fostering transformative learning were described in this case study, additional case studies might explore adding new elements and using different combinations of these elements. Nielsen and Nielsen (2006) describe an approach that

might be combined with the six elements called the critical utopian approach. Rather than focusing on problem solving, the critical utopian approach relies on social imagination, thought experiments and the creation of alternative futures as a means toward knowledge creation. This approach and in particular the use of scenario planning has been described by Bawden and Reichenbach (2010) as a means of learning.

Mezirow and Associates (2000) have written that reflection on premise is the least often engaged in type of reflection. It is through reflection on our premise and vetting of these premises that deep learning can begin to occur in individuals. While individual reflection occurred in the SMCFP, reflection on premise was observed in only one individual. Providing additional time and space for reflection on assumptions, and in particular those hidden assumptions behind the participants' sociolinguistic and epistemological habits of mind, might provide for deeper learning and transformation of meaning perspectives.

Limitations

This research was designed to answer three research questions. The limitations of the research design include a focus on rational dialogue and a focus on the individual as the unit of analysis. This study has approached understanding transformative learning among individuals in a collaborative process from a rational viewpoint. There are other viewpoints from which the research questions might have been examined. Two of these have been described by Cranton (2006) as connected or relational ways of knowing and extrarational viewpoint. The relational way of knowing examines the development of relationships between the participants in the collaborative process. As stated by Taylor

and Snyder (2012), “In every review of transformative learning, the role of relationships has been identified as being significant in the process of transformation” (p. 43). Finally the extrarational approach is one that examines transformational change from an imaginative or emotional lens. The extrarational is described by Lawrence (2012) as “a process of meaning-making expressed through symbol, image, and emotional expression” (p. 472). Each of these approaches offers a unique perspective from which to answer the research questions. For more detail, Taylor, Cranton and Associates (2012) provide an overview of transformative learning based on rational, extrarational and relational approaches in “*The Handbook of Transformative Learning: Theory, Research, and Practice.*”

To better understand the limitation imposed by the choice of the individual as the unit of analysis, it is helpful to understand Mezirow’s response to Collard and Law’s (1989) critique of transformative learning theory. Collard and Law (1989) pointed out a gap between the social construction of meaning by individuals and social action. The critique suggested changes in individual social-psychological assumptions and social action were not sufficiently described. Mezirow (1989) responded stating social action is a learner’s choice and through free association with others the discovery that "one is not alone" may lead to solidarity and social action. (p. 172). Cranton and Taylor (2012) state:

There is a seeming disconnect between the critical social perspective and the constructivist and humanist perspectives: the former has a social “unit of analysis”; the latter, an individual “unit of analysis,” . . . Transformative

learning theory need not be about individual transformation or social change; it is about both. (pp. 9-10)

Related to but different from the critical social perspective is transformative learning's relation to group learning. Transformative learning theory and group learning have been examined by Yorks and Marsick (2000). Yorks and Marsick connect group learning with the literature on group dynamics and describe groups as entities that are capable of learning. Senge (1990) also describes organization learning in this way. These authors examine transformational learning in collaborative processes and the links between learning and action using the group as a unit of analysis.

Implications for Extension Educators

This section is written in the first person and reflects my learning process and implications for educational practice with specific emphasis on Extension education. There are two implications for my teaching. First, I have become aware of multiple characteristics of the collaborative process that might be used to foster transformative learning. Second, fostering transformative learning may provide a bridge between individual learning and learning for social action. I will first discuss alternative approaches to linking learning and change. Second I will address how transformative learning may help educators find synthesis between teaching for the participant's benefit and teaching for societal benefit. I will conclude with a brief discussion about how what I have learned is congruent with O'Sullivan's (2012) ecologic approach to transformational learning.

The SMCFP provides an effective model for addressing complex economic, environmental and social issues. It fosters transformative learning through the presentation of expert knowledge, dialogue, and deliberation. The links between learning and change in the SMCFP included a project focus, creating time and space to explore local and expert knowledge, dialogue, deliberation and reflection. It was apparent in the SMCFP that the interaction of these elements led to transformational learning.

Fostering transformative learning in collaborative processes and educational programs can “result in changes in how participants understand important social issues and how they choose to take action” (Reichenbach, Muth & Smith, 2013). Mezirow’s transformative learning theory posits rational dialogue as an integral part of transformative learning. From this study, I have learned participants, when given time and space, may form their own norms for dialogue. These norms parallel Mezirow’s criteria for rational discourse. Mezirow (2000) states fostering the “liberating conditions for making more autonomous and informed choices and developing a sense of self-empowerment is the cardinal goal of adult education” (p. 90).

Reichenbach, Muth and Smith (2013) describe three different approaches to fostering transformative learning: a phenomenological approach, an imaginative approach and a utopian approach. It is through the use of multiple processes that we, as educators, can foster the conditions for transformative learning and thus enable participants to make their own choices about how to act. Reichenbach, Muth and Smith state,

As educators, we can encourage transformative learning by providing the learner and the learning helper the means to examine their own ways of knowing. By starting with participant meanings and understanding, possibilities open for new ways of interaction, ownership of the learning process, and action. (Conclusion)

When I first entered the EdD program at the University of Minnesota Duluth I was seeking to learn if I, as an Extension Educator, should focus my efforts on helping landowners do good things on their property or if I was to focus on changing management actions across the landscape to benefit society? I have sought and found praxis between benefit for the individual and benefit for society in the process of transformational learning. Taylor (2009) states:

One framework . . . involves a collection of theoretical orientations that emphasize personal transformation and growth, where the unit of analysis is primarily the individual, with little attention given to the role of context and social change in the transformative experience . . . The second framework . . . sees fostering transformative learning as being as much about social change as personal transformation, where individual and social transformation are inherently linked. (p. 5)

Finally, my view of transformational learning is personal rather than individual. Individual has a focus on the person and not the system. Personal is a concept introduced by O'Sullivan (2012). Personal is holistic and recognizes that change in the system within which participants are embedded can create

disorienting dilemmas. The adult educators' role is to 1) foster the development of the person and 2) to create awareness of factors in the environment or system that might affect the learner.

Conclusion

This qualitative case study was an exploration of the links between learning and action in a collaborative process. This study adds to the growing body of literature regarding the characteristics of the learning environment that foster transformative learning (Rodela, 2011). The study provides evidence of transformations in each of the four types of transformative learning described by Mezirow: elaboration of frames of reference, creation of new meaning schemes, transforming meaning schemes, and transforming meaning perspectives (Mezirow, 2000, 2009, 2012). It extends understanding of how people learn in a collaborative process and provides a foundation for the design of adult education programs and future research.

The SMCFP and the introduction of the AFEX process served to make dialogue about change in agricultural production salient. Six elements including a project focus, expert and local knowledge, dialogue, deliberation and reflection fostered transformative learning. Dialogue and deliberation with others holding diverse viewpoints softened or led to elaboration of existing frames of reference, the creation of new meaning schemes and the transformation of existing meaning schemes. Only one participant, M1, showed strong evidence of transforming of meaning perspectives. Providing additional time and space for individual reflection may increase the depth of learning and increase the number of participants who show evidence of transformation of meaning perspectives.

Ultimately transformation of meaning perspectives may lead to participants having a more complete understanding of the topic at hand. However, individual participants in a collaborative process will exhibit different types of transformative learning and that learning may occur as individual inspiration, incrementally or after a delay of months or years.

For the Extension educator or researcher developing a collaborative process, fostering the participants' freedom to define their own social norms has consequences for how the participants view the legitimacy of the process. The educator or researcher must observe and attend to the contextual elements of project focus, expert knowledge and local knowledge adjusting the process to provide participants freedom to define their own social norms for dialogue and deliberation. Reflection on content, process and premise is an essential element that provides the basis for all but the adoption of new frames of reference. Exploring the conditions that foster transformative learning in the SMCFP has extended the understanding of transformative learning by showing how deliberation and dialogue are two separate and important elements in the process.

The SMCFP provided participants with the opportunity to vet ideas through a geo-design tool and assess impacts of change in farming practice. The interviews and focus groups provide evidence that transformation in meaning schemes were common and transformation in perspective was evident for one individual. The participant experience of the SMCFP was positive. This positive energy promoted learning, opened participants to new ideas and created discussion about changing the agricultural landscape.

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Appendices

Appendix A: Invitation to Conduct Dissertation Research

UNIVERSITY OF MINNESOTA

Twin Cities Campus

**Department of Agronomy
and Plant Genetics**

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September 12, 2012

Mr. Michael Reichenbach,
Cloquet Forestry Center Z0402A
175 University Rd
Cloquet, MN 55720-9594

Dear Mr. Reichenbach,

As PI of the research project referenced below, it is my our pleasure to invite you to conduct research toward an EdD degree in Teaching and Learning as part of our Conservation Innovation Grant (CIG) project entitled *Spatial Modeling and Collaborative Landscape Design to Improve Nutrient Management, Agricultural Productivity, and Ecosystem Services in the MRB*. I understand the purpose of your research is to develop a program theory describing the link between learning and action from the perspective of participants in a collaborative planning process. The CIG project may provide an excellent opportunity for you to answer your research questions. The CIG project is aimed at improving nutrient management in the Minnesota River Basin. The project is being conducted by a team of researchers at the University of Minnesota College of Food, Agricultural and Natural Resource Sciences, College of Design, and the Humphrey School of Public Affairs and the non-governmental organization Rural Advantage. The project aims to use deliberation, visualization and landscape modeling to promote the implementation of multi-functional agricultural in the Minnesota River Basin. If successful, this project will shift traditional agricultural practice toward inclusion of perennial grasses and other crops. The project location is near New Ulm, Minnesota, where two subsections of the Minnesota River will provide a geographic focus. The collaborative planning process will involve approximately ten stakeholder meetings, which will start in the Fall 2012. The participants will include agri-business and environmental NGOs, agricultural producers and government agency representatives involved in agriculture and natural resource management.

Sincerely,



Nicholas Jordan
Professor, Agroecology

Appendix B: Logic Models for Workshops One

Logic Model, Workshop 1 -- June 26, 2013				
Situation	Goals	Inputs	Outputs	Outcomes
<p>We are trying to bring a diverse group together to design and plan biomass production areas and infrastructure for a planned biomass processing facility. We have selected the vicinity of Seven Mile Creek watershed near St Peter MN as a potential biomass production area. We call this area a "fuelshed" As a group, we will answer the question 'what do we grow, and where, and for what purpose', to produce annual crops and biomass, and improve soil and water and wildlife conservation in the fuelshed. We will use a variety of visualization and modeling tools to support our work together. The biomass processing facility will use a new biomass processing technology, ammonia fiber expansion (AFEX).</p>	<p>Meeting Intent: RT3, 5/29/13, "the group will be focusing on the larger landscape including the watershed but also the landscape immediately adjacent to the watershed."</p> <p>"The intent of this meeting is to kick-off the project, introducing the stakeholders to the project and research. The meeting is also intended to help familiarize participants with the landscape, create a shared understanding of project intent, and initiate working relationships with and among stakeholders." (RT6)</p> <p>Participants are expected to have an understanding of the SMCFP. Participants will also have opportunities to get to know each other, setting the stage for this to be a collaborative design process. It is hoped the stakeholders will take a broader view as a result of looking at the big picture and look for win-win opportunities.</p>	<p>Discussion about who to select: RT2, 4/22/13, "The main question is do we want to include people who have quite entrenched views and are in some sense lobbyists, or do we want people who are less political?"</p> <p>RT5, response, 4/22/13, "I will weigh in to say that I think we do want those folks with a point of view. They are relevant stakeholders and would likely benefit from a collaborative process that facilitates sharing of multiple points of view, including their own."</p> <p>RT1 response, 5/9/13, "I think we do want to include folks who have power and influence by virtue of their affiliations and network connections. Many of these folks will be advocates as you note, RT2, but the hope is the our collaborative process will identify some win-win paths forward."</p>	<p>Meeting Summary On June 26, 2013 the Seven Mile Creek Fuelshed Planning Project kicked off at the Melva Lind Interpretive Center at Gustavus Adolphus College in St. Peter, Minnesota. The meeting started with an introduction to the project by RT1, Project Lead. Next, participants introduced themselves along with providing a brief summary of their interest in participating in this project. After introductions RT3 provided an overview of the landscape tour.</p> <p>Participants took a tour of the Seven Mile Creek Watershed. After the tour, participants worked through individual worksheets and small group discussions on key questions. The meeting concluded with an overview of the research being conducted, a participant survey, and a tentative schedule of the project.</p>	<p>Some participants voiced strong opinions about the AFEX process including "not enough info to make a decision" and "this location is wrong. This is the most productive area of the state; there is not enough biomass to support an AFEX facility." RT6 "This process may not lead to a plan. It is a way to learn and work together across topics/issues that pertain, or are of interest, to those involved. We happen to be doing research as part of this project. This is to better understand the collaborative process: 'What works? When do people learn? How do they form relationships?' I think we want to encourage folks to remain involved, even if they are confused or have concerns about this as the testing grounds."</p>

Appendix B, continued: Logic Models for Workshops Two

Logic Model, Workshop 2 -- July 31, 2013		
Situation	Goals	Outputs
<p>The completion of meeting 1 left many participants with questions about what we wanted to accomplish, if AFEX/producing biomass was viable/desired in a highly productive agricultural watershed.</p> <p>RT1, 7/15/13 7/31, "we were, [in workshop 1], trying to use the Seven Mile area as a way of figuring out whether/when/where/what kind of biomass agriculture could deliver a win-win from production and conservation points of view, and that we did not assume that Seven Mile was a place where we could get that win-win from biomass agriculture. So I hope we are positioned to work well and collaboratively with the participants.</p>	<p>RT1, June 28, 2013 "Our goal for this session is to present more detail on the notion of biomass production for AFEX processing in the 'fuelshed' area we are proposing to include more detail on AFEX, more detail on biomass options, and more detail on where in the fuelshed area this biomass could be produced. Essentially, consider and deliberate the proposition that a meaningful level of biomass production could occur in the fuelshed area, for AFEX value-added processing, without interfering much with the current agricultural production. The outcome that we seek is to move toward a shared understanding of the merits of that proposition: 'What's to like about it?', 'What concerns arise?' and 'What are the key unknowns?'. The likely outcome of the session is that we identify some points of general agreement in the group, some points of disagreement and some points of uncertainty.</p>	<p>Attendees were invited to respond to the following question: "What are one or two things that make the Seven Mile Creek Watershed unique or special that we should not lose sight of as we consider biomass agriculture?"</p> <ul style="list-style-type: none"> • It's beauty. • It's (relatively) diverse topography. • Proximity to the MN river. • It is a designated trout stream. • This watershed is typical in size to numerous others in the MN Basin (can be replicated). • Part of it is publicly owned. • Landowner participation with current studies/previous projects. • Diverse landscapes. • Diverse communities (people who use watershed). • Importance of production agriculture. • Watershed has extensive and intensive river related analysis. • Verdant/productive low crop agricultural area. • Good case study area, highly monitored/good background data. • Fairly small geographical area within the watershed. • Livestock opportunities. • There are a lot of really smart people here. • Proximity to Mankato agricultural processing centers. • The aesthetic appeal of a landscape that includes both production and conservation. <p>The meeting wrapped up with a discussion of the biomass "pie," focusing on potential sources for biomass. Attendees were asked to assume that 750,000 tons/year of biomass to support 10 AFEX plants. Attendees considered five potential sources of biomass including: (1) annual grasses – e.g. sorghum, (2) exotic grasses – e.g. <i>Miscanthus sp.</i>, (3) native grasses – e.g. switchgrass, (4) prairie mix, and (5) stover. Each attendee reflected on potential factors that might be considered in evaluating potential sources of biomass in the Seven Mile Creek Watershed, including technology, policy, price of commodities, incentives, environmental benefits, demand/profit, and attitudes/culture. Following this individual reflection, each attendee was asked to draw a biomass pie, which identified a viable distribution of potential sources of biomass. Small groups were then formed and participants were invited to develop a consensus biomass pie.</p>

Appendix B, continued: Logic Models for Workshops Three

Logic Model, Workshop 3 -- August 28, 2013		
Situation	Goals	Discussion and Outputs
<p>RT4, 7/31/2013, An accommodation of interests and ideas appears to be a part of the process. A back and forth deliberation about ideas, rather than a deep change in perspective, ways of knowing or being.</p> <p>There is a continuous adjustment and reflection on the process by the research team. This adjustment is often due to questions and response to the presentations. Workshop 2 generated information about perceived acreage of the landscape in various cover types. Stover was already being used. It will be interesting to see how this shifts with the geo-design / visualization tools to be introduced in workshop 5.</p> <p>There was more positive energy in the group after workshop 2.</p> <p>Throughout the project RT4 has been concerned that there has not been enough time for participants to reflect and get to depth with their discussions and thinking about what they have learned. RT1 echo's this concern as follows: [8/22/13] Yes, I agree that linking George and Mark's presentations and creating a longer period of discussion will be better. One of our challenges is to enable discussions to go to reasonable depth, so that there can (possibly) be some genuine exchange of views and dialogue about those views. To enable that depth/dialogue, we have to create space for it in the agenda and not have too many different tasks/activities/questions for them.</p>	<p>This meetings focus is on Habitat / Water Quality. What are win-win end results?</p> <p>There is a need to take a look at the opportunity to achieve conservation via biomass agriculture in this region, and also enable discussion of the nuances of this opportunity.</p> <p>Are participants aware of the approaches and projects that have been successful – can biomass agriculture amplify the success of these projects?</p> <p>To 'size up' opportunities for soil, water and wildlife conservation that are created by the cultivation of biomass crops of various sorts in Seven Mile Creek watershed and environs (i.e., the surrounding area). There has been a generalized claim, by us as workshop organizers and many others, that biomass agriculture offers a major win-win for conservation and production, however, it is crucial to explore that prospect in detail, so our goal in this workshop is 'open up the hood' and examine it. In essence, I see this workshop as the place where the conservation community gets to talk about what they need to 'get' from biomass agriculture -- in terms of increased conservation -- in order to feel enthusiastic about biomass agriculture.</p>	<p>How can biomass production contribute to your <u>habitat</u> priorities? Any concerns or reservations?</p> <p>The following text was captured by participant worksheets. Not all worksheets were collected.</p> <ul style="list-style-type: none"> Concern: invasive species, economic feasibility, tendency toward mono-cropping systems. Many perennial biomass crops also increase water quality, soil health, etc. that can make land more productive for cash crops in a rotation. Increase diversity, concern re non-natives. <p>What are your priorities regarding <u>water quality</u> in the Seven Mile Creek Fuelshed?</p> <ul style="list-style-type: none"> Develop market-driven practices to enhance quality. Retain more water on uplands, reduce sediment entering streams. Reduce N loading to MN River. Decrease cropland synthetic N requirements through land management practices. <p>The meeting concluded with a discussion about balancing conservation and production benefits of biomass. Participants were invited to describe their characteristics of what a "win" would look like for each of the four items discussed over the course of the last two meetings (July – food and biomass, August – habitat and water quality), and also describe what a "win-win-win-win" scenario would look like.</p>

Appendix B, continued: Logic Models for Workshops Four

Logic Model, Workshop 4 -- Wednesday September 25, 2013		
Situation	Goals	Activities
<p>RT1, 9/9/13, Our plans for the 4th workshop, are to integrate the thinking we have done over the first 3 workshops to identify a set of design criteria for biomass production that will help participants work together to consider how biomass production could be situated in an agricultural landscape so as to produce environmental and social benefits in addition to biomass.</p> <p>As we saw from George's presentation, the distribution of 'hotspots' where large conservation benefits results from land-use change are by no means congruent across different conservation outcomes.</p> <p>Our 4th workshop might have 3 elements, 1) Gain perspective on what we've discussed and learned together so far. 2) Work with touchscreens to consider the implications of using biomass production to produce conservation outcomes.</p>	<p>RT1, 9/13/13, The plan for the day is to integrate the insights that have emerged from our work in the previous workshops, and, through further discussion, develop a set of rules of thumb that could guide biomass production so that we get as much profitable production and effective conservation as possible. We will then try out and refine those rules of thumb in our remaining workshops, in which we will bring our big touchscreens and decision-support models.</p> <p>RT1, 9/24/13, We concluded that giving our folks time to more deeply discuss the 'rules of thumb' and their integration required creating additional space in the agenda and we are definitely planning on a warm-up spatial exercise next month.</p>	<p>The main focus of the day was to develop both general and specific guidance as we move into the design workshops in the following months. Participants engaged in individual and group activities to respond to discussion questions.</p> <p>What do we need to keep in mind (not lose sight of) as we increase biomass production in the Seven Mile Creek Fuelshed?</p> <p>The second discussion was focused on developing "rules of thumb" for designing for food, biomass, habitat, and water. Participants spent roughly twenty minutes at a topic table (food, biomass, habitat, water). They were invited to write down "rules of thumb" that started with a verb on individual worksheets as a way to collect their thoughts. Next, participants were encouraged to discuss these rules of thumb with their group and write them on a large post-it note in the middle of the table. After 20 minutes, participants went to a different table, engaged in the same activities but with a different topic. Each person was invited to be part of all four topics. The following is a record of what was recorded at each topic table.</p> <p>During this exercise, participants were invited to partake in a small group discussion. We had three tables of four participants, and a small group facilitator. Participants were asked to come to a group consensus on top "rules of thumb" to achieve a win-win-win scenario.</p>

Appendix B, continued: Logic Models for Workshops Five

Logic Model, Workshop 5 -- Wednesday October 30, 2013					
Situation	Goals	Inputs	Activities/Agenda	Outputs	Outcomes
Workshop 5 is the first time the participants will have seen the geo-design stations.	<p>Participants will become familiar with the design stations and produce one or more designs</p> <p>To familiarize participants with the touch screen technology, layers, animation tools, and saving a screen shot. There will be two short exercises.</p> <p>The goal is to develop a regional diagram that takes into consideration some spatial consideration of the four topics we have been talking about and the rules of thumb that seem relevant to design. Small groups may develop a few different scenarios but the goal is that they have one group regional diagram by the end of the day.</p>	<p>RT1, 10/21/13, In our fourth biomass production planning workshop participants developed "rules of thumb" about how biomass production should be done. We will 'try out' these rules in our 10/30/13 workshop. "Rules of thumb" are actionable and can be used to guide biomass production in a watershed or landscape.</p> <p>Now, it would be very helpful to get insights on how biomass production should be done from everyone who was unable to join us for the September 25th workshop. Therefore, we have devised a quick survey to get your thoughts. As well, anyone else receiving this message is welcome to take the survey. The survey will take about 10 minutes to complete.</p>	<p>Exercise #1</p> <p>The point of this exercise is to familiarize participants with the touch screen technology, layers, animation tools, and saving a screen shot. There will be two short exercises for folks to do. The first exercise is getting used to the drawing tools, zooming in and out. The second exercise uses layers and will familiarize participants with the aerial view of the watershed.</p> <p>Exercise #2: Regional Scale Design: The goal of this exercise is to develop a regional diagram that takes spatial data into consideration. The goal is to have diagram for each group by the end of the day.</p>	<p>RT1, 10/30/13, We decided that remixing groups will allow a broader range of interchange among folks from different sectors. 2) We discussed the activity for 11/20. Presuming that fresh groups will be given 5000 acres to design, we might pose them the premise that some 350 acres need to be converted to biomass production, at an average yield of 5 tons per acre. These figures assume a 10 mile maximum haul to AFEX depot, and supply of 200 tons/day. At 5 tons per acre, this requires 14400 acres of land within the 200000 acres (a circle of 10 mile radius).</p>	<p>RT3, 11/1/13, I was very pleased with the activity generated at the St. Peter meeting, especially with the fact that the design stations actually seemed to engage almost all of the audience in meaningful conversation about the design multifunctional landscapes. The group that I facilitated actually saved the designs as they were generated in an iterative process. This means we actually have some data to use!</p>

Appendix B, continued: Logic Models for Workshops Six

Logic Model, Workshop 6 -- Wednesday December 18, 2013			
Situation	Goals	Outputs	Outcomes
<p>RT1, 11/6/13, Apologies for this calendar rearrangement, but we would like to cancel our 11/20 workshop.</p> <p>We've decided to make a few key enhancements to the 'decision-support' software that we'll be using at our next workshop. This software will allow you to get projected economic and environmental performance information on the biomass production scenarios that you'll be creating. We didn't have that capability for the regional scale scenarios you created on October 30, and we are excited about how this additional information will enhance the thinking we'll do together when we meet in December. BUT we need a bit more time to augment the system, based on what we heard on October 30.</p>	<p>RT5 and RT1, 1) We start out with giving them time in small groups to 'test-drive' the [geo-design] system. We do the first worksheet which asks them to think some about how they might expect that a rule of thumb could be applied to guide land-use change to advance a particular aspect of conservation or production. In the afternoon, they draw upon how land-use change affects production/conservation to come up with the 500 acres of biomass.</p> <p>RT3, 12/16/13, Then after lunch, they come up with their one preferred design solution. The USpatial folks have devised a means of showing all five preferred group designs in a single representation and providing an overall sense of performance across the six performance criteria. So this system will give them a sense of how the combination of their individual designs for the ~5000 acres in which they are working will work across all groups working in all five areas will perform..</p>	<p>RT2, Jan 10, There are some interesting differences in performance for these five designs. The South and East groups were the only ones able to obtain significant environmental gains. While the South was profitable, the East was not. The other three designs were all profitable, but did not show significant environmental gains.</p>	<p>RT2, 12/19/13, I am surprised that so much land can be put into stover removal without marked water quality impact. Evidently the stover was located away from water quality and erosion risks. Next time, work on improving the sediment and P reduction performance of the current designs. Work on refining the whole-watershed design. RT2, question, how do people use rules of thumb and feedback indicators to come up with designs? How do they compare focus group designs with various optimization model designs? For the next meeting - relax the emphasis on profit from farming operations. We could ask them what they see as reasonable goals for sediment, P, habitat, discharge.</p> <p>RT4, 12/20/13, I like the idea related to focusing on the entire watershed. If we are trying to understand how participants learn and move toward taking action to achieve market-driven (AFEX), incentive-driven, and education-driven approaches to targeted land-use change, it might be helpful to provide time for each participant to reflect on what we have accomplished. A question, or short exercise, something along the lines of "Think about what you know about the AFEX process and think about what you have accomplished using the visualization tools and think about how changing land use within the watershed might affect annual crop production, water quality, habitat and biomass. Has how you think about crop production, water quality, habitat and biomass changed for the Seven Mile Creek Watershed? If so, in what ways. I see this individual reflection time.</p>

Appendix B, continued: Logic Models for Workshops Seven

Logic Model, Workshop 7 -- Wednesday December 18, 2013				
Situation	Goals	Activities/Agenda	Outputs	Outcomes
Participants have experience with the geo-design tool and created a design for portions of the watershed.	<p>The "goal" of this workshop is for folks to better understand landscape performance and then design at the watershed scale for these performance targets.</p> <p>RT6, Jan 24, 2014, Participants will consider in their designs landscape features (such as property boundaries) that control what practices are employed.</p> <p>Targets will be provided via RT2. This will include at least a 5% land area in biomass production and the following, a 25% reduction in sediment and phosphorus losses, 10% improvement in habitat, \$10/ac loss in market value, or a profit in market return, and 2,500 tons carbon sequestration/yr.</p>	Participants will discuss their design from workshop 6, discuss what they like and don't like about it and the watershed design as a whole, In other words, some time to reflect and dialogue about goals that are meaningful to them as a group for the day's design activity.	<p>Five designs for the entire watershed.</p> <p>Participants will discuss their rules of thumb and reasons they created the designs the way they created them.</p>	<p>A deeper understanding of how conceptually an AFEX fuel depot might provide the means to have produce income from farming, to increase habitat, to improve water quality.</p> <p>Participants are likely to experience a better understanding of how a 5% land area in biomass production can achieve wins in all four indicators.</p> <p>What might lead the participants to move toward action and next steps. What still needs to happen?</p>

Appendix B, continued: Logic Models for Workshops Eight

Logic Model, Workshop 8 -- March 7, 2014	
Situation	Outputs
<p>The final workshop. The geo-design tools will be used to design a watershed scale design. The group has developed a positive social dynamic that makes discussion easy. The geo-design tool is engaging although not without glitches.</p>	<p>Participants found that despite diverse backgrounds they could work together to explore biomass production. Some participants were surprised by how much biomass could be produced without large reductions in farm income. Participants were positive about moving forward to explore some of the unanswered questions. The next exploration of biomass production and AFEX should include local officials, farmers, commodity groups, bankers, business owners, and community leaders.</p> <p>Some questions remained regarding feasibility, the AFEX process, and the next steps. These included,</p> <ul style="list-style-type: none"> • Will incentives be need to make it feasible? • How will this work when implemented on a farm by farm basis? • What equipment is needed to harvest bio-crops? • There are environmental concerns about AFEX. • How much water will the process use? • What are the waste products? Is stover harvest sustainable? <p>The process changed the way some participants thought about agricultural production, water quality and habitat. Specifically,</p> <ul style="list-style-type: none"> • "We've seen how we can boost environmental and economic productivity." • "That conservation and agriculture can share the same area successfully." • "Production agriculture can remain on large swaths of land and as long as appropriate conservation practices are implemented appropriately . . . we can still see huge amounts of environmental benefit." • "I really wasn't thinking about 'new' market opportunities before [be] coming engaged in this process."

Appendix C: Agenda Seven Mile Creek Fuelshed Project Workshop 1

Seven Mile Creek Fuelshed Planning Process

Meeting Agenda

Wednesday June 26, 2013

Melva Lind Interpretive Center, Linnaeus Arboretum at Gustavus Adolphus College
St. Peter, Minnesota

Time	Details	
9:00 – 9:10	Welcome, Sign In coffee, muffins	
9:10 – 9:25	Fuelshed Planning Process Presentation	Jordan
9:25 – 9:50	Introductions	
9:50 – 10:00	Landscape Tour Overview	Pitt, Zerger
10:00 – 10:10	Break, board bus	
10:10 – 2:30	Landscape Tour see map for site locations & details	
11:30 – 12:00	Lunch at Seven Mile Creek Park	
2:30 – 2:45	Break	
2:45 – 4:00	Wrap Up Activity Research Consent Next Steps	Schively-Slotterback Reichenbach

Project Contact Information
Nick Jordan, Professor
College of Food, Agricultural and Natural Resource Sciences
Department of Agronomy and Plant Genetics
University of Minnesota
612-625-3754
jorda020@umn.edu

Appendix C, continued: Agenda Seven Mile Creek Fuelshed Project Workshop 2

Seven Mile Creek Fuelshed Planning Project Agenda

Meeting

Wednesday July 31, 2013
St. Peter Community Center, Senior Community Room
St. Peter, Minnesota

Time	Details	
10:30 – 10:40	Presentation Project Purpose and Path	Jordan
10:40 – 10:50	Kick-off Question <i>What are one or two things that make the Seven Mile Creek Watershed unique or special that we should not lose sight of as we consider biomass agriculture?</i>	Slotterback
10:50 – 11:30	Presentations Minnesota's Food Production System Seven Mile Creek Biomass Feedstock Scenarios	Mulla
11:30 – 12:10	Discussion Opportunities & Constraints – Production of Food and Biomass	Slotterback
12:10 – 12:40	Lunch	
12:40 – 1:00	Presentation AFEX Biomass Process & Economics	Jordan
1:00 – 1:20	Discussion Prospects for AFEX	Slotterback
1:20 – 1:35	Presentation Biomass Crop Options	Jordan
1:35 – 2:20	Discussion Biomass "Pie"	Slotterback
2:20 – 2:30	Survey Next Steps	Slotterback Jordan

Future meeting dates and discussion topics are available on the back of this sheet.

Appendix C, continued: Agenda Seven Mile Creek Fuelshed Project Workshop 3

Seven Mile Creek Fuelshed Planning Project

Meeting Agenda

Wednesday August 28, 2013
St. Peter Community Center, St. Peter Room
St. Peter, Minnesota

Time	Details	
10:30 – 10:50	Introduction & Overview	Jordan, Zerger
10:50 – 11:20	Presentation Assessing Ecological Quality & Environmental Stressors for Landscape-scale Conservation Design	George Host Natural Resources Research Institute University of Minnesota-Duluth
11:20 – 11:50	Presentation Habitat & Biomass Production	Mark Lindquist Minnesota Department of Natural Resources
11:50 – 12:15	Discussion	Slotterback
12:15 – 12:45	Lunch	
12:45 – 1:20	Presentation Minnesota Water Quality Issues	David Mulla University of Minnesota-Twin Cities
1:20 – 2:20	Discussion	Slotterback
2:20 – 2:30	Survey Next Steps	Slotterback Jordan

Appendix C, continued: Agenda Seven Mile Creek Fuelshed Project Workshop 4

Seven Mile Creek Fuelshed Planning Project

Meeting Agenda

Wednesday September 25, 2013
St. Peter Community Center, Senior Center Room
St. Peter, Minnesota

Time	Details	
10:30 – 10:50	Introductions	
10:50– 11:20	Presentation Biomass Planning Workshops: Review & Preview	Jordan
11:20 – 12:20	Designing for Food, Biomass, Water, Habitat Rounds 1,2,3	Slotterback
12:20 – 12:50	Lunch	
12:50 – 1:20	Designing for Food, Biomass, Water, Habitat Round 4	Slotterback
1:20 – 2:05	Designing for the Win⁴	Slotterback
2:05 – 2:15	Primer for future workshops Presentation on technology, small group work	Pitt
2:15 – 2:30	Next Steps Survey	Jordan Slotterback

Appendix C, continued: Agenda Seven Mile Creek Fuelshed Project Workshop 5

Seven Mile Creek Fuelshed Planning Project

Meeting Agenda

Wednesday October 30, 2013

Nicollet County Building, Emergency Management Conference Room
St. Peter, Minnesota

GOAL FOR TODAY:

The goal of today's meeting is to have small groups of participants work collaboratively to create landscape designs for the area around the Seven Mile Creek watershed. Creating these designs will offer participants the opportunity to integrate their thoughts about locating areas for production of food and biomass while also enhancing habitat and water quality in working rural landscapes.

Time	Details	
10:30 – 10:40	Introductions	
10:40 – 10:55	Presentation Review & Preview, Rules of Thumb	Jordan
10:55 – 11:05	Technology Overview	Kne
11:05 – 12:00	Design Exercises Getting used to information and technology	Pitt
12:00 – 12:30	Lunch	
12:30 – 1:30	Regional Landscape Design	Pitt
1:30 – 1:50	Reflection on Process Worksheet	Zerger
1:50 – 2:20	Report Back Presentation of designs and response to reflection questions	Zerger
2:20 – 2:30	Next Steps Survey	Jordan Slotterback

Appendix C, continued: Agenda Seven Mile Creek Fuelshed Project Workshop 6

Seven Mile Creek Fuelshed Planning Project Agenda

Meeting

Wednesday December 18, 2013

St. Peter Community Center, Senior Center Room
St. Peter, Minnesota

GOAL FOR TODAY:

The goal of today's meeting is to have small groups of participants work collaboratively to create landscape designs for a portion of the Seven Mile Creek watershed. Creating these designs will offer participants the opportunity to consider performance measures of different landscape practices.

Time	Details	
10:30 – 10:40	Welcome and Introductions	
10:40– 10:50	Presentation Meeting #5 Summary	Jordan
10:50 – 11:00	Technology Overview	Kne
11:00 – 11:20	Exercise #1	Zerger
11:20 – 12:15	Exercise #2	Zerger
12:15 –	Lunch	
12:45		
12:45 – 1:30	Exercise #3	Zerger
1:30 – 2:10	Small Group Presentations	Slotterback
2:10 – 2:30	Next Steps Survey	Jordan Slotterback

Appendix C, continued: Agenda Seven Mile Creek Fuelshed Project Workshop 7

Seven Mile Creek Fuelshed Planning Project Agenda

Meeting

Wednesday January 29, 2014

St Peter Community Center, Senior Center Room
St Peter, Minnesota

GOAL FOR TODAY:

The goals for today's meeting is to review the designs and performance from workshop #6 and have small groups of participants work collaboratively to create a watershed scale design using target performance objectives

Time	Details	
10:30 – 10:40	Welcome and Introductions	
10:40– 11:10	Presentation Meeting #6 Summary	Mulla
11:10 – 11:30	Target Performance Measures	Mulla
11:30 – 12:00	Small Group Design	
11:20 – 12:15	Exercise #1	
12:00 – 12:30	Lunch	
12:30 – 1:45	Small Group Exercise Continued	
1:45 – 2:20	Small Group Presentations	
2:10 – 2:30	Next Steps Survey	Slotterback

Appendix C, continued: Agenda Seven Mile Creek Fuelshed Project Workshop 8

Seven Mile Creek Fuelshed Planning Project

Meeting Agenda

Friday March 7, 2014

Emergency Management Center Room, Nicollet County Building
St. Peter, Minnesota

GOAL FOR TODAY:

The goals for today's meeting are to work collaboratively to create landscape designs for the Seven Mile Creek watershed with target performance measures in mind, reflect on the overall project process, and consider next steps.

Time	Details	
10:30 – 10:35	Welcome and Introductions	
10:35– 10:45	Meeting #7 Summary	Jordan
10:45 – 12:00	Designing the Watershed	
12:00 – 12:30	Small Group Reports	Slotterback
12:30 – 1:00	Lunch	
1:00 – 1:30	Process Reflection	Slotterback / Zerger
1:30 – 1:50	Next Steps / Group Q&A	Jordan
2:00 – 2:30	Focus Groups	Reichenbach

Appendix D: Participant' Invitation to the SMCFP

Invitation to Participate in University of Minnesota Seven Mile Creek "Fuelshed" Project

Dear [insert name]

We are contacting you with an invitation to participate in an economic-development and research project that is being organized by the University of Minnesota. We are hoping to engage a range of community and industrial partners in developing a new sustainable commercialization pathway for lignocellulosic biomass. Our pathway is based on an emerging biomass processing technology, ammonia fiber expansion (AFEX), which creates high-value biomass commodities that can be sold for bioenergy, bioproducts, ruminant animal feed, and combustion energy. Specifically, our work will promote sustainable commercialization by identifying and de-risking biomass production and supply-chain systems that provide economic value, multiple ecosystem services (e.g. water quality, wildlife habitat), and social benefits for farmers, landowners and rural communities. Please see the attached project overview for additional information. This project is funded by the U.S. Department of Agriculture through a Conservation Innovation Grant and the University of Minnesota's Initiative for Renewable Energy and the Environment.

Critical to our efforts is the engagement of key stakeholders such as yourself. We have selected the Seven Mile Creek Watershed in Nicollet County as a potential "Fuelshed" for an AFEX facility that might be located in the region in the future. We hope that you will consider participating in a series of eight approximately monthly meetings. Our intent is to use a design and planning process to explore the environmental, economic, and social implications of various plans for biomass production in the Seven Mile Creek fuelshed area. We hope to draw on and exchange knowledge among a wide range of participants, and we will use a variety of visualization and modeling tools to support stakeholder exploration of multiple future scenarios.

We are planning an initial meeting on June 26, and would very much welcome your attendance. The meeting place will be held at Gustavus Arboretum in St. Peter, MN. Funding for mileage is available to participants, as well as an honorarium for persons able to accept it.

Please email reich027@umn.edu if you would be interested in participating in the stakeholder effort. I will call you to discuss this effort and look forward to speaking with you.

Sincerely,

Seven Mile Creek Fuelshed Project Team
 Nicholas R. Jordan, Professor, Department of Agronomy and Plant Genetics
 David G. Pitt, Professor, Department of Landscape Architecture
 Carissa Schively Slotterback, Associate Professor, Humphrey School of Public Affairs
 David Mulla, Professor, Department of Soil, Water and Climate
 Cindy Zerger, Research Fellow, Humphrey School of Public Affairs
 Michael Reichenbach, Doctoral Candidate, University of Minnesota Duluth, Department of Education

Appendix E: Seven Mile Creek Fuelshed Project Description

Seven Mile Creek 'Fuelshed' Planning Project

University of Minnesota, Rural Advantage, and University of Minnesota Extension

We are bringing a diverse group together to design and plan biomass production areas and infrastructure (storage areas, etc) for a planned biomass processing facility. We have selected the vicinity of the Seven Mile Creek watershed near St. Peter, MN as a potential biomass production area. We call this area a 'fuelshed'. As a group, we will answer the question 'what do we grow, and where, and for what purpose', to produce annual crops and biomass, and improve soil water and wildlife conservation in the fuelshed. We will use a variety of visualization and modeling tools to support our work together. The biomass processing facility will use a new biomass processing technology, ammonia fiber expansion (AFEX).

- AFEX treated biomass can be pelletized, producing a dry, stable, high-density commodity product.
- AFEX pellets can be directly fed to ruminant animals, providing a nutritional energy source similar in quality to grain. Ruminant feed markets thus could create strong immediate demand for AFEX pellets, providing excellent market opportunities for farmers in the fuelshed area.
- AFEX biomass processing will be done in depots (Fig. 1) that will handle 100 tons of biomass per day. Depots could be co-located with current grain elevators or manure digesters, receiving biomass from farms located within a 5 to 10 mile distance, greatly reducing biomass transportation costs.
- AFEX technology is relatively low-cost and depots could be locally-owned by coops, providing opportunities to retain value and profit in rural communities.
- Biomass feedstocks include annual crop residues (e.g., corn stover), various double crops, 'biomass' alfalfa, and a range of perennial biomass crops. Biomass from these sources on approximately 10% of the fuelshed land area (roughly, 35,000 acres) can provide 100 tons/day of biomass to the depot.
- If these 35,000 acres are strategically located in the fuelshed, significant benefits for soil, water and wildlife conservation will result, in addition to economic opportunities for farmers and rural communities.
- To plan the fuelshed area, we will hold a series of 8 ½-day workshops (tentative schedule on back). During the workshops, participants will develop, explore, and evaluate multiple specific possibilities for location of biomass production and infrastructure in the fuelshed area.

Who Should Participate:

- Individuals and groups who are interested in helping to develop plans for the fuelshed area near Seven Mile Creek/St. Peter Minnesota, including crop and dairy farmers, landowners, agency and non-profit staff, educators, custom harvesters, and others.
- Individuals and groups who are interested in the planning approach being used in this effort. We believe this process is widely applicable to other areas in Minnesota.

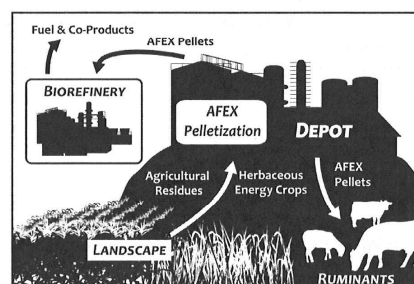


Figure 1. Local AFEX biomass preprocessing depots densify and increase the value of diverse herbaceous biomass feedstocks, which can then be used by livestock and biorefineries.

Tentative Workshop Schedule (all sessions are ½ day except for the first).

The first 3 workshops are opportunities for learning and dialogue about where biomass crops might be situated within the fuelshed area. That area is farmable land within 5-8 miles of the planned AFEX depot near the Seven-Mile Creek watershed. Via a field trip, presentations, and facilitated discussions, the group will explore how production of various biomass crops could provide food, biomass, and soil, water and wildlife conservation. We will explore both 'win-win' opportunities and trade-offs between production of food, biomass, conservation, and recreation in the fuelshed area. We believe there are many significant win-win opportunities. Also, we think that many of the trade-offs can be reduced by using a range of information about soils, hydrology and habitat to site various kinds of crops across the fuelshed area. We are looking forward to bringing a broad group together to think these possibilities through, and that is the purpose and plan for the first three meetings

After these initial meetings, we will move into a second stage. We will work together to develop specific plans for producing biomass in the fuelshed area. Biomass can be produced from both annual sources, such as corn stover and cover crops, and perennial crops. As a group, we will answer the question 'what do we grow, and where, and for what purpose' to produce annual crops and biomass, and improve soil water and wildlife conservation in the fuelshed. We will use a set of computer support tools that will let the group visualize specific plans and to evaluate their relative performance in terms of production and soil, water and wildlife conservation. We will do this work on several different scales, roughly townships, small watersheds, and sections. We are not trying to plan the whole fuelshed area, of course, but rather we are looking for specific ways to produce biomass, annual crops and conservation benefits abundantly and efficiently. In other words, if 'win-win' possibilities exist, what do these actually look like? Then we can take these lessons and apply and adapt them to other parts of the fuelshed area, and elsewhere in the state.

We are asking participants to participate in the entire planning process. We also understand that your schedules may not permit you to attend all sessions. Should this be the case and you still wish to participate please let us know. For those who can accept reimbursement and honoraria, we are offering to reimburse your mileage at the GSA rate and to pay an honorarium of \$100 per workshop for individuals who have been able to attend at least six of the eight workshops. Due to UMN accounting procedures, this payment will be made after the 8th and final workshop.

June 26, 2013 – Workshop 1 – Overview/Field Trip (all day)

July 31, 2013 – Workshop 2 – Opportunities: Food + Biomass

August 28, 2013 – Workshop 3 – Opportunities: Habitat + Water

September 25, 2013 – Workshop 4 – Trends Exploration/Integration + Development of Landscape Design Criteria

October 30, 2013 – Workshop 5 – Design I: Largest Scale – Region (e.g. townships that intersect with watershed)

November 20, 2013 – Workshop 6 – Design II: Medium Scale – Subset of watershed and fuelshed

December 18, 2013 – Workshop 7 – Design III: Smallest Scale – Site (1 section or farm)

January 29, 2014 – Workshop 8 – Performance/Implementation/Next Steps

Appendix F: IRB Exempt for the Seven Mile Creek Fuelshed Project



Mike Reichenbach <reich027@umn.edu>

1304E30781 - PI Jordan - IRB - Exempt Study Notification.

1 message

Mike Reichenbach <reich027@umn.edu>
To: Mike Reichenbach <reich027@umn.edu>

Mon, Sep 22, 2014 at 12:07 PM

From: <irb@umn.edu>
Date: Wed, Apr 3, 2013 at 3:18 PM
Subject: 1304E30781 - PI Jordan - IRB - Exempt Study Notification
To: reich027@umn.edu

TO : jorda020@umn.edu, reich027@umn.edu, cschively@umn.edu, czerger@umn.edu, pittx001@umn.edu,

The IRB: Human Subjects Committee determined that the referenced study is exempt from review under federal guidelines 45 CFR Part 46.101(b) category #2 SURVEYS/INTERVIEWS; STANDARDIZED EDUCATIONAL TESTS; OBSERVATION OF PUBLIC BEHAVIOR.

Study Number: 1304E30781

Principal Investigator: Nicholas Jordan

Title(s):
Spatial Modeling to Improve Nutrient Management, Agricultural Productivity, and Ecosystem Services in the MRB (Seven Mile Creek Fuelshed Project)

This e-mail confirmation is your official University of Minnesota HRPP notification of exemption from full committee review. You will not receive a hard copy or letter.

This secure electronic notification between password protected authentications has been deemed by the University of Minnesota to constitute a legal signature.

The study number above is assigned to your research. That number and the title of your study must be used in all communication with the IRB office.

Research that involves observation can be approved under this category without obtaining consent.

SURVEY OR INTERVIEW RESEARCH APPROVED AS EXEMPT UNDER THIS CATEGORY IS LIMITED TO ADULT SUBJECTS.

This exemption is valid for five years from the date of this correspondence and will be filed inactive at that time. You will receive a notification prior to inactivation. If this research will extend beyond five years, you must submit a new application to the IRB before the study's expiration date.

Upon receipt of this email, you may begin your research. If you have questions, please call the IRB office at (612) 626-5654.

You may go to the View Completed section of eResearch Central at <http://eresearch.umn.edu/> to view further details on your study.

The IRB wishes you success with this research.

Appendix G: SMCFP Consent Form

Consent Information Sheet

Spatial Modeling to Improve Nutrient Management, Agricultural Productivity, and Ecosystem Services in the Minnesota River Basin (Seven Mile Creek Fuelshed Project)

Overview

We have identified you as a relevant resource related to a current research project examining approaches to advancing nutrient management, agricultural productivity, and ecosystem services in the Minnesota River Basin. This project will integrate spatial modeling and collaborative stakeholder planning approaches to assess the impacts of alternative land management practices through a “Fuelshed” Project in the Seven Mile Creek area of Nicollet County. The project is funded by the U.S. Department of Agriculture through a Conservation Innovation Grant. Additional support is provided by the University of Minnesota’s Initiative for Renewable Energy and the Environment. The intent of the project is to explore how stakeholders use information about water quality, agricultural production, and environmental performance in making decisions about how land should be managed.

You were selected as a resource because of your experience in natural resources planning/policy, agricultural production/policy, and/or land use planning/policy. We ask that you read this form and ask questions prior to engaging in this study.

Background

By agreeing to take part in the study, we will invite you to participate in two phone or in-person interviews, to complete brief surveys, and to participate in a focus group at the end of the stakeholder process for the “Fuelshed” project. The interviews will take 30-60 minutes each, the survey approximately five minutes at each stakeholder meeting, and the focus group approximately 60-90 minutes at the end of the stakeholder process. Interviews will be recorded and interview notes will be taken by the researcher(s). Responses to surveys will be tracked via an ID number system, that will track participants’ responses, without tracking their name or affiliation. The focus group will be recorded and interview notes will be taken by the researchers. You may opt out of the any of these data collection efforts.

Risks and Benefits of Being in the Study

This study has no likelihood of personal risk.

Compensation

Mileage expenses will be available to process participants for travel to stakeholder meetings. An honoraria of \$100 per workshop will also be available to participants who attend at least six of the eight workshops. The honoraria will be paid after the last workshop.

Confidentiality

The records of this study, including the responses provided in the interview, surveys, and focus group, will be kept private. In any published materials produced from this study, your identity will remain confidential. However, you do have the option to waive confidentiality. Research records will be kept as password protected computer files. No hard copy records will be retained. The results of all interviews and surveys will be destroyed at the end of the project.

Voluntary Nature of the Study

Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota. If you decide to participate, you are free to withdraw at any time without affecting these relationships.

Contacts and Questions

The researcher(s) involved in the interviews are University of Minnesota faculty, staff, and students. You may ask questions of the researchers at any time. If you have questions later, you may contact the principal investigator for the project, Nicholas R. Jordan at: Department of Agronomy and Plant Genetics, University of Minnesota, phone (612) 625-03754, email: jorda020@umn.edu.

If you have questions or concerns regarding this study or would like to talk to someone other than researcher(s), contact the University of Minnesota's Research Subjects' Advocate Line, D528 Mayo, 420 Delaware Street SE, Minneapolis, Minnesota 55455, telephone (612) 625-1650.

Statement of Consent:

I have read the above information. I have asked questions and have received the necessary answers. I consent to participate in the study.

Appendix H: IRB Exempt for the Research Team Journals



Mike Reichenbach <reich027@umn.edu>

1305E32421 - PI Reichenbach - IRB - Exempt Study Notification

1 message

irb@umn.edu <irb@umn.edu>

Mon, May 6, 2013 at 1:13 PM

To: reich027@umn.edu

TO : sdamme@umn.edu, reich027@umn.edu,

The IRB: Human Subjects Committee determined that the referenced study is exempt from review under federal guidelines 45 CFR Part 46.101(b) category #2 SURVEYS/INTERVIEWS; STANDARDIZED EDUCATIONAL TESTS; OBSERVATION OF PUBLIC BEHAVIOR.

Study Number: 1305E32421

Principal Investigator: Mike Reichenbach

Title(s):

Researcher Perspectives of the Collaborative Planning Process for Spatial Modeling to Improve Nutrient Management, Agricultural Productivity, and Ecosystem Services in the Minnesota River Basin (Seven Mile Creek Fuelshed Project)

This e-mail confirmation is your official University of Minnesota HRPP notification of exemption from full committee review. You will not receive a hard copy or letter.

This secure electronic notification between password protected authentications has been deemed by the University of Minnesota to constitute a legal signature.

The study number above is assigned to your research. That number and the title of your study must be used in all communication with the IRB office.

Research that involves observation can be approved under this category without obtaining consent.

SURVEY OR INTERVIEW RESEARCH APPROVED AS EXEMPT UNDER THIS CATEGORY IS LIMITED TO ADULT SUBJECTS.

This exemption is valid for five years from the date of this correspondence and will be filed inactive at that time. You will receive a notification prior to inactivation. If this research will extend beyond five years, you must submit a new application to the IRB before the study's expiration date.

Upon receipt of this email, you may begin your research. If you have questions, please call the IRB office at (612) 626-5654.

You may go to the View Completed section of eResearch Central at <http://eresearch.umn.edu/> to view further details on your study.

The IRB wishes you success with this research.

Appendix I: Research Team Consent Form

Researcher Perspectives of the Collaborative Planning Process for Spatial Modeling to Improve Nutrient Management, Agricultural Productivity, and Ecosystem Services in the Minnesota River Basin (Seven Mile Creek Fuelshed Project)

BACKGROUND: As an investigator or facilitator involved with the Seven Mile Creek Fuelshed Project's collaborative planning process, I have identified you as a relevant resource examining the link between learning and action. Specifically, my interest is to describe and explain the collaborative planning process used in this project and changes in perspectives that may occur as the process emerges. This research is a part of a larger research project examining approaches to advancing nutrient management, agricultural productivity, and ecosystem services in the Minnesota River Basin.

PROCEDURES: This research is being conducted by Mike Reichenbach, Doctoral Candidate Teaching and Learning, UMD Department of Education. I ask that you read this form and ask questions prior to engaging in this study. By agreeing to take part in this research, you will be asked to complete a journal at the end of each collaborative planning workshop. There will be between 8 and 10 workshops over the course of this research. A set of questions will be used to guide your journaling. You may complete the journal in any manner that is convenient to you. I will have forms that you may use if you desire. I will also provide an option for completing the journal on-line. Your responses will be tracked via an ID number system so you will not have to attach your name to the journal entry. You may opt out of this data collection effort.

RISKS, BENEFITS AND COMPENSATION: This study has no likelihood of personal risk. No compensation will be available for your participation.

CONFIDENTIALITY: The records of this study will be kept private. In any published materials produced from this study, your identity will remain confidential. However, you do have the option to waive confidentiality. Research records will be kept as password protected computer files. No hard copy records will be retained. The journals will be destroyed at the end of the project.

VOLUNTARY NATURE OF THE STUDY: Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota. If you decide to participate, you are free to withdraw at any time without affecting these relationships.

CONTACTS AND QUESTIONS: The researcher involved in collecting this data is a Doctoral Candidate with the University of Minnesota Duluth, Department of Education. You may ask questions at any time. If you have questions later, you may contact the principal investigator for the project, Mike Reichenbach at University of Minnesota,

phone (218) 726-6470, email: reich027@umn.edu or his advisor, Dr. Susan Damme, at sdamme@d.umn.edu, 218-728-2886.

If you have questions or concerns regarding this study or would like to talk to someone other than researcher(s), contact the University of Minnesota's Research Subjects' Advocate Line, D528 Mayo, 420 Delaware Street SE, Minneapolis, Minnesota 55455, telephone (612) 625-1650.

STATEMENT OF CONSENT: I have read the above information. I have asked questions and have received the necessary answers. I consent to participate in the study.

Appendix J: SMCFP First Interview Guide

Thank you for taking them time to participate in today's interview. Your time and your open and honest viewpoints are appreciated.

The purpose of this discussion is to explore the relationship between learning and action in collaborative planning processes. Your responses will be kept confidential, you will be provided a code number that will be used maintain your anonymity to all excluding the researchers. The code number will be applied to all of the data collected. To ensure that the descriptions used reflects your experience and statements, a summary of this interview will be provided to you for review.

The questions below are a guide and will be used to provide structure to the interview. As these questions are a guide, the interview should be seen as a discussion. Please provide honest and complete responses. Both positive and negative impressions are important. You are encouraged to share experiences that are relevant to learning in and action taken as a result of collaborative planning processes.

The following questions pertain to your previous experience with collaborative planning. If you do not have experience with collaborative planning, we will focus on your hopes and expectations for the current collaborative planning process.

Questions 1-11 relate to your sense of what it has been like for you to be a part of a previous collaborative planning process.

Guiding Questions:

- 1) Before today, have you participated in a collaborative planning process? If not skip to question 12.
- 2) What was the topic of the collaborative planning process?
- 3) Please describe the process you were involved with.
Learning can be considered differences before and after a collaborative planning process regarding your understanding of the topic.
- 4) What was your experience of learning, as it pertains to the collaborative planning process? What did you learn? Your new understanding might be based on new facts, new ways to solve problems, new perspectives, or changes in beliefs and values.
- 5) Describe how your views of the topic or how you understood the topic may have been strengthened or changed. In other words, prior to your collaborative planning experience you may have understood the topic differently than how you understood the topic after the experience.
- 6) Can what you learned be applied in other settings? Consider how the facts, new knowledge of how to solve a problem, new perceptions might apply in other settings.
- 7) How did the collaborative process trigger your learning? What was there about the collaborative process that was helpful in helping you learn?

- 8) Did the collaborative planning process you participated in result in an action on your part? If yes, how did learning contribute to your taking action? Action can be a deeper participation in developing a plan as well as implementing the plan.
- 9) Think about discussions with other collaborative planning process participants and the different views on the topic that they may have held. Describe what you observed. If you observed different views than you own: What was different? How did it feel? Why was it different? What resulted?
- 10) Is there anything else about your collaborative planning experience that you want me to know?

Finally, I am interested in your hopes and expectations for this collaborative planning process as these hopes and expectations relate to learning and action.

- 11) Regarding learning: What do you hope to learn? This may be about new things, ways of doing things, learning about others perspectives.
- 12) Regarding action: What will make this collaborative planning process successful for you? What is success?
- 13) From your understanding of the project is there anything missing? What might you want to learn about that is not included in the process?
- 14) Is there anything else you want me to know about your expectations for this collaborative planning process?

Appendix K: SMCFP Second Interview Guide

Thank you for taking time to participate in today's conversation. With your permission I will record this conversation. Do I have your permission to record?

Your open and honest viewpoints are appreciated. Both positive and negative impressions are important. You are encouraged to share your experience as it is relevant to learning and changes in understanding.

The first question relates to the process used in the Seven Mile Creek Fuelshed Project and your recollection of events.

- 1) Based on the Seven Mile Creek Fuelshed Project workshops you attended please recall and describe what it was like to be a part of the process.

Learning can be considered new understanding based on new facts, new ways to solve problems, new perspectives, or changes in beliefs and values. Regarding learning and the Seven Mile Creek Fuelshed Project:

- 2) What change, if any, has occurred in how you view the production of annual crops, biomass, improvement of water quality and increased habitat? *In other words, describe how your views of the topic or how you understood the topic may have been strengthened or changed. For example, prior to the Seven Mile Creek Project you may have understood these topics differently than how you now understood these topics, describe that change.*
- 3) What was there about the Seven Mile Creek Process that was helpful to your learning? *It may be helpful to probe thinking about the concept diagram and the steps outlined in the instrumental / communicative learning diagram we developed.*

Finally, Now that the Seven Mile Creek Fuelshed Project has concluded, I'd like to ask you to reflect on what you learned and on the full series of workshops you attended:

- 4) What would make the process used in the Seven Mile Creek Fuelshed Project better or more successful? *Did the Seven mile creek project meet your expectations. Was the project successful from your viewpoint? What worked? What did not?*
- 5) Is there anything else about your experience with the Seven Mile Creek Fuelshed Project that you would like to tell me about?

Appendix L: SMCFP Focus Group Questions
Seven Mile Creek Fuelshed Project Workshop
Friday March 7, 2014

Thank you for taking them time to participate in today's focus group. Your time and your open and honest viewpoints are appreciated.

We have about 30 minutes for our conversation today and I have 2 primary questions for you. After each question, I'll give you a moment to write your thoughts down on the note cards provided. Then we'll open things up for discussion. At the end of this focus group, I'll be collecting your cards so be sure to also write down any ideas you had but were unable to share with the group in the allotted time. You are encouraged to share your experiences and what you have learned from the Seven Mile Creek Fuelshed Project.

1) Based on your experience in the 7 Mile Creek Fuelshed Project Workshops please describe what it was like to be a part of the process. *(Probing questions) Related to the process, what did you observe? What was said? What was done: with whom? by whom?*

2) As a result of your experience in the Seven Mile Creek Fuelshed Project, what change, if any has occurred in how you view the production of biomass, farm income, enhancement of habitat and protection of water quality? *(Clarifying questions) For example, prior to your participation in the Seven Mile Creek Fuelshed Workshops you may have understood the biomass production, income generation, enhancement of habitat and protection of water quality differently than how you understood the these topic now. A discussion with another participant who held a different view or valued things differently from you may have changed how you think or how you might act regarding that topic. You may have come to a common understanding.*

Appendix M: Research Journal Guide

Thank you for agreeing to keep a brief journal about your experience with today's collaborative planning session. Your time and your open and honest viewpoints are appreciated.

The purpose of this study is to develop a theory that describes the link between learning and action. As an outcome of Mike Reichenbach's work, a logic model, describing the key steps in the collaborative planning process and a theory of action describing the link between learning and action from an education theory perspective will be developed. The following prompts are provided as a means to organize your thoughts. I ask that you return to me, Mike Reichenbach a copy of your journal immediately after each planning session. You may also enter your thoughts at [insert weblink]

Respondent # _____ Date _____

1. Based on today's collaborative planning sessions, what observations or connections did you make between the process used, and learning or intentions to act? What was done? What was said?
2. This question asks you to reflect on the meaning of what happened. Did the process affect what or how you perceive learning? What occurred? What meaning do you attach to what happened or to what was said?
3. This question asks you to reflect on what you learned. What did you learn? Is there anything that you or others should do to change the process thus far? What is it? Did you think the process used today was appropriate to increasing participant learning and participant action? Why or Why not? What are the next steps and why?
4. Finally, Do you have any additional comments about the workshop? Think about both the group dynamics, and the process used during the day. For example, the suitability of the facility, the educational content provided, or the discussion process used.

Appendix N: The Listening Method, Listening for the Story

MIKE: All right. I have the recorder going. Um...did you get a chance? I...I had just a um...

G2AUGUST1: Yeah I have it opened right now in front of me.

MIKE: Okay good. It...it may be helpful. I don't follow the questions exactly. It's more conversation, kind of...

G2AUGUST1: Sure

MIKE: And what I'm doing is um...trying to explore the relationship between learning and action within collaborative processes. Um...

G2AUGUST1: Okay

MIKE: and so the first set of questions um...and on the sheet before you that covers the first ten really pertain to collaborative processes that you had experience with um...and the last few questions pertain to the Seven Mile Creek Fuelshed project in particular. So um...I'd like to start talking about your experience with collaborative processes or collaborative planning processes and um...find out if you've participated in one, what your roll was um...what you think a collaborative process is, those types of things s if you want to...if you've got some ideas or things that you'd like to share regarding your experience.

G2AUGUST1: Sure yeah, I mean I'll just jump right off where...what I had started telling you about yesterday. I was just an observer in this process. I was just trying to learn kind of um...I wasn't actually one of the stake holders or facilitators so I wasn't actively involved in the process but it was a...it's called structured decision making and I am not sure where it came out of or anything. It was just my academic advisor at the time was participating in this project and had me come along as a learning experience for um...maybe running future focus groups or something but um...it's basically gathering all of the stakeholders involved in a collaborative decision so in that case it was...it was regarding land use um...and it was I believe a plot of land that a church had donated to the city and there was a bit of indecision over how that plot

G2 tells a story of learning about the collaborative process and provides detail on the importance of selecting a wide range of stakeholders being patient, and listening finally being sure to value all participants opinions.

G2 I poem seeks to clarify G2's role in the processes seeks to be understood by others

Appendix N, continued: The Listening Method, Listening for Voice

of these farmers on are these are the questions to be asking, am I missing anything, so on and I found it really important to rather than um...assume that I was right or that my survey was complete or whatever to really listen with an open ear to what these people had to say because they were the ones that I was trying to get the opinion from so I don't know. I guess the learning that came out of it was just being very patient and tolerant of all opinions and actively working to incorporate them all into the outcome rather than just hearing them but actually try and incorporate them.

MIKE: Okay. And how, in your experience, you know...so as someone who has facilitated being patient and tolerate of all the opinions and incorporating those into the final product um...how...how well received was that by the participants?

G2AUGUST1: I think it made them more willing to talk.

MIKE: Okay

G2AUGUST1: Um...knowing that their opinions was being respected. They were more willing to say what was actually on their minds rather than putting up a wall right away of this person doesn't care anyway and this isn't going to amount to anything.

MIKE: And...and through that process um...did you personally or did the people...some of the people in the room...did...did it result in changed perspectives or changed viewpoints?

G2AUGUST1: Um...not necessarily no but we were able to have a very productive discussion um...and the goal wasn't to change any viewpoints. It was...it was more to hear viewpoints which is why I said I very loosely apply the framework.

MIKE: Okay.

G2AUGUST1: Yeah there was definitely a productive discussion.

MIKE: All right um...you've already talked about...I'm on question six...you've already talked about, you know, how and what you've learned in one of these settings is applied in another and so

I poem a story of
discovery checking her
facts --

learning about
process of collaboration
as it requires
patience and
tolerance of
others opinion
active involvement
and incorporation
of those opinions
into the outcome.
resulting in
a greater
willingness of
participants to
talk.
not necessarily
resulting in a
change in
viewpoints or
perspectives

Appendix N, continued: The Listening Method, Answering the Research Questions

MIKE: Hmm-mmm. So...um...from your experiences, were there some lessons that you've learned that you can, you know, maybe apply to the Seven Mile Creek process? Or other collaborative processes?

MIJULY15: Well it...it is a process or a situation where, at least from my standpoint, and I know just about everybody else who participated in the four last month and far more experienced in environmental water, all those sorts of things than I do. Um...their professionals in the field, I'm not. But um...for me it's pretty much a learning process and there can be ah-ha moments where I go "ah-ha! Okay" so that's why you know such and such so um...for me it will just be a learning...a lot of learning but also listening um...to what other people have to say about things and the different sides of any kind of a...an issue. Um...I think I've lost track of exactly what the question was.

MIKE: Yeah no...you're...you're right on target. It's kind of how can you apply what you've had...learned in past

MIJULY15: Right okay

MIKE processes

MIJULY15: so it's...it's really you have to sit back and listen and then make your decision going from the information that you have presented to you.

MIKE: Hmm-mmm. I...I...you know...that...that listening process that you bring up I...you know...I've...I've jotted a note down about that

learning process
respect
listening new theme

Appendix O: Themes -- Experience of the Collaborative Process

Emergent Themes	Interview One: From the participants' perspective, what were the key elements of a collaborative process?	Interview Two: What were the key elements of the SMCFP?
	Exhibited by Participant (out of 21)	Exhibited by Participant (out of 8)
1. Diversity	A1, B1, C2, F1, G2, L1, R1, S1, T1, U1, V1, Z1	C2, G2, J1, L1, V1
2. Have a voice / Listening / Respect / Open to being vulnerable	G2, L1, M1, Q1, R1, V1, W1, X1	G2, J1, L1, U1
3. Dialogue-Discussion	A1, E2, F1, L1, M1, O1, W1, X1	J1, L1, M1
4. Goal-Action Orientation	A1, C2, J1, M1, O1, W1, X1	--
5. Clear Objective, Clear Process, Flexible Process, Leadership	C2, E2, O1, V1, X1	C2, U1
6. Open Mindedness / Open to Learning	E2, G2, M1, O1, U1	U1, V1
7. Common Experience	E2, L1, O1	L1
8. Common Understanding	G2, T1	--
9. Absence of Language of resistance	X1	--
10. Expert presentations	--	G2, M1
11. Geodesign tool	--	G2, J1, L1, U1
12. Credibility	--	J1, M1, U1
13. Share with others	--	J1
14. Reasons to come back	--	N1
15. Who participates	A1, G2, N1	N1, U1
16. Importance of History	--	N1
17. Tangible outcomes	V1	V1

Appendix P: Themes -- Experience of Learning

	Interview One: What were the participants' previous experiences regarding learning in a collaborative setting?	Interview Two: What were the participants' experiences of transformational learning in the SMCFP?
Open and Closed Themes (Themes 3, 4 and 5 are based on Wiggins and McTighe (2006) Six Facets of Understanding)	Exhibited by Participant Exhibited by (out of 21)	Exhibited by Participant Exhibited by (out of 8)
1. Collaborative process leading to understanding/ action	L1, N1, P1	J1, N1, U1, V1
2. Finding common ground	A1, E2, F1, L1	G2
3. Instrumental learning (Understanding, explanation and application)	B1, C2, F1, J1 L1, M1, Q1, S1, V1, Z1	C2, J1, L1, N1, U1, V1
4. Communicative learning (Perspective and empathy)	B1, C2, E2, F1, G2, J1, L1, M1, O1, P1, R1, S1, T1, U1, V1, X1, Z1	G2
5. Premise reflection (Self-knowledge)	S1, U1, X1, Z1	M1
6. Change in beliefs, values and attitudes	--	C2, G2, L1, M1, N1, U1
9. Two way flow of knowledge	Q1, S1, U1, V1, X1	--
10. Sophistication of thinking	U1, V1, X1, Z1	G2, L1, U1
11. Importance of geo-design tool in thinking about how	--	C2, J1, V1